THE

JOURNAL

OF

GAS LIGHTING,

WATER SUPPLY,

Etc.

VOL. LXXXVII.

JULY TO SEPTEMBER, 1904.

LONDON:

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXVII. No. 2147.] LONDON, JULY 5, 1904. [56TH YEAR. PRICE 6d.

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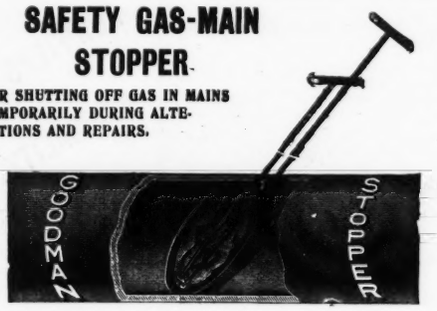

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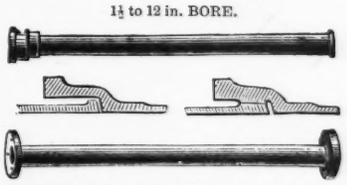

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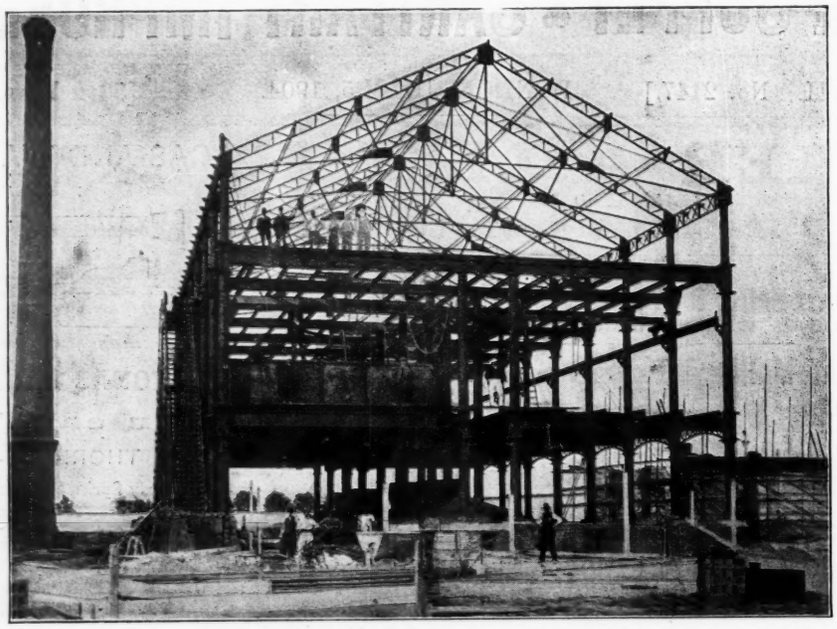

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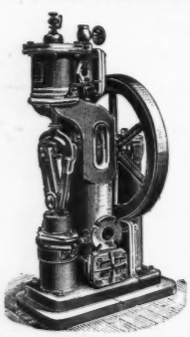

Fig. 705. "SINGLE RAM" STEAM-PUMP.

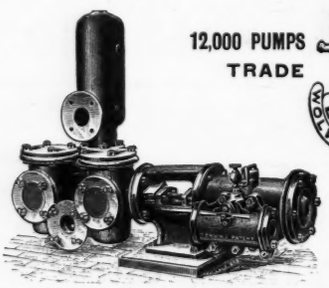

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

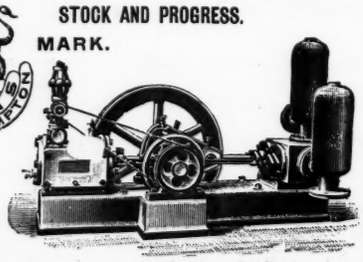

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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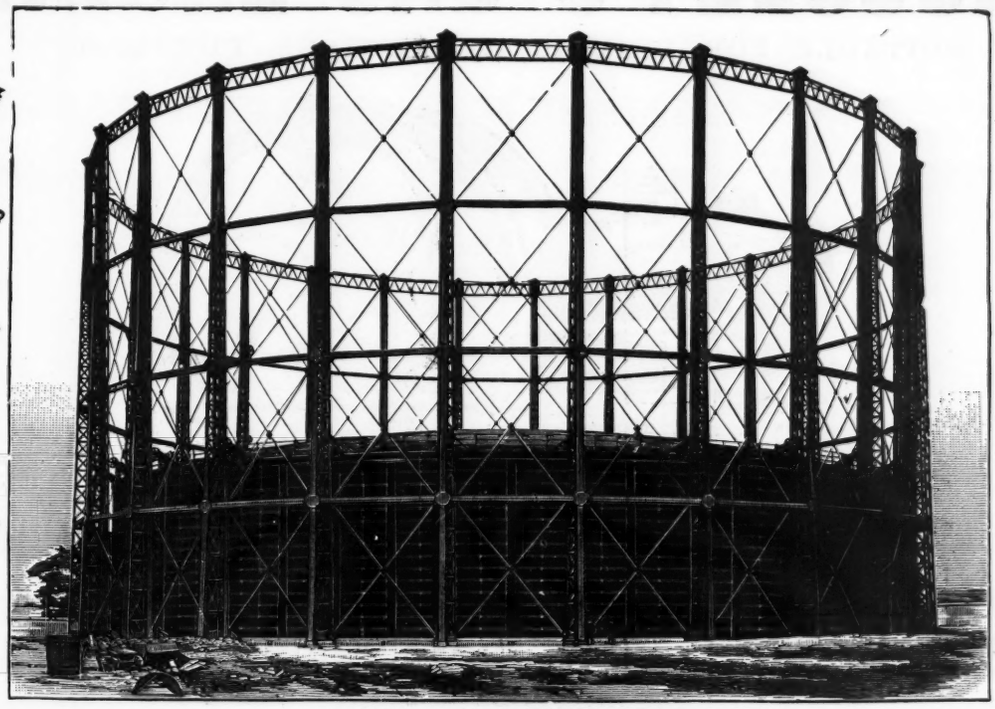

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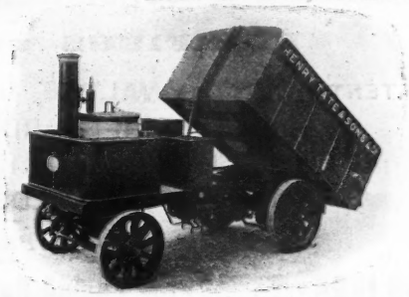

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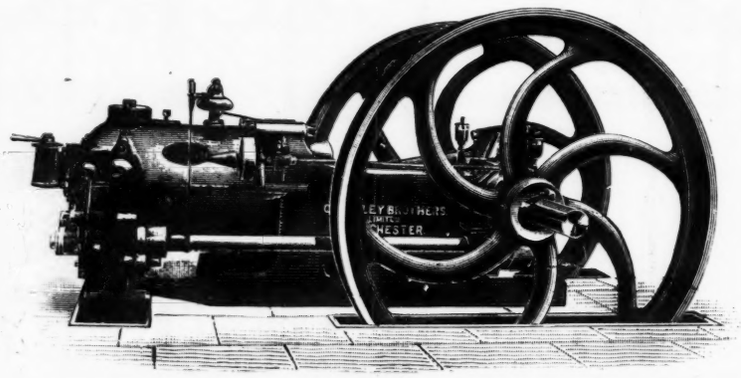

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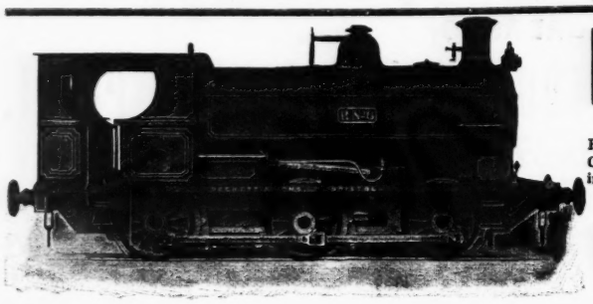

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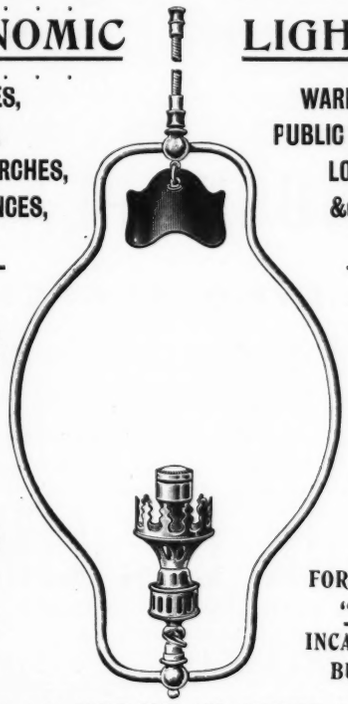

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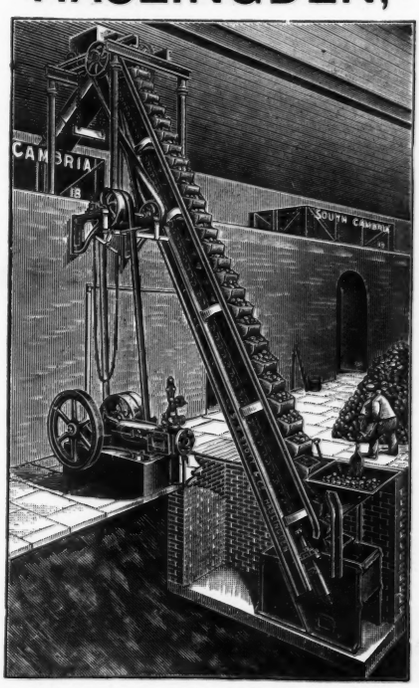

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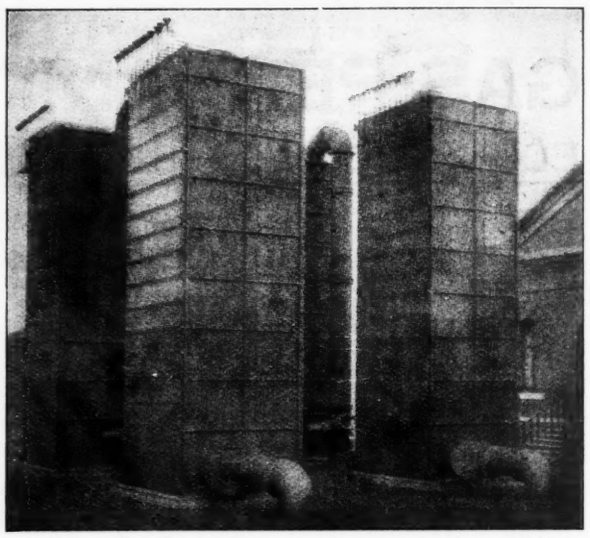

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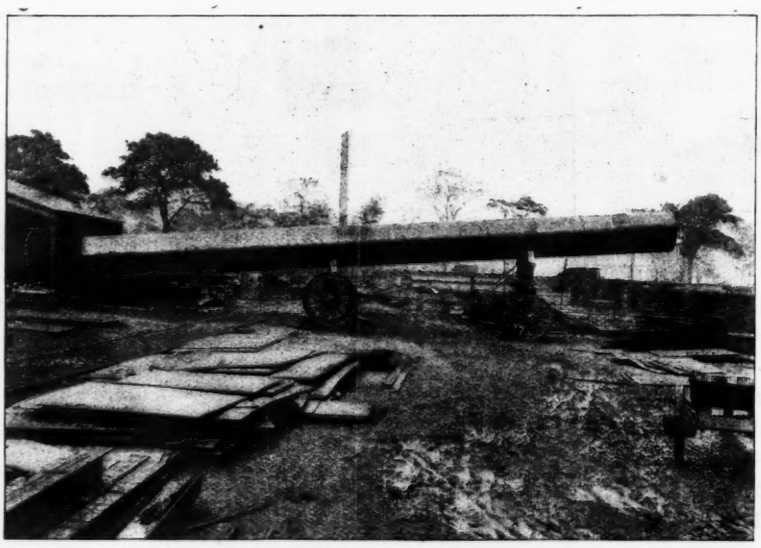

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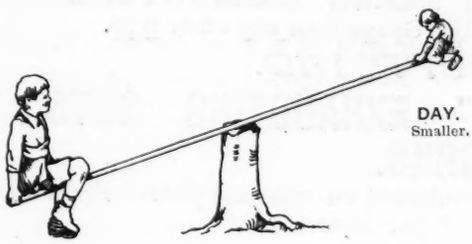

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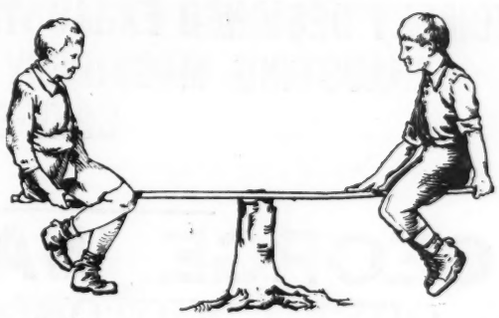

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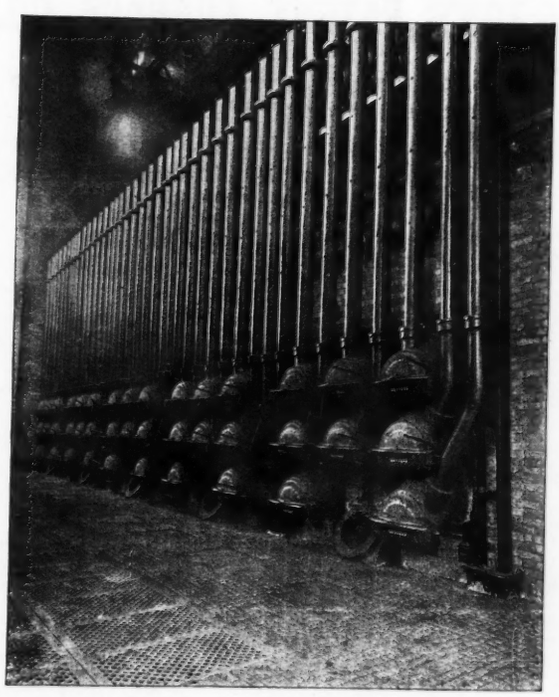

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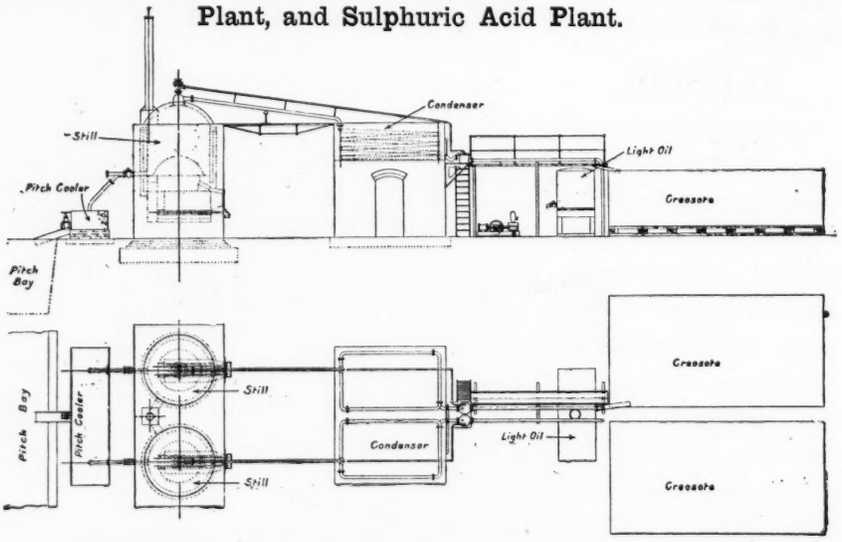

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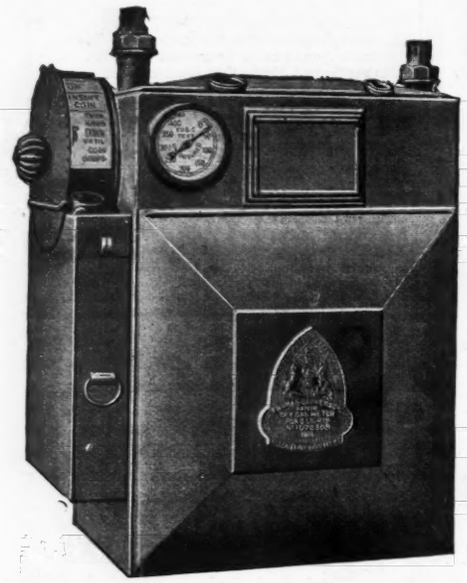

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EDITORIAL NOTES—GAS, &c.

Laying the Sulphur Bogey.

IN the instalment published to day of the report of the proceedings before the Departmental Committee on the testing of London gas and other matters, there will be found a valuable report and evidence by Mr. Otto Hehner and Dr. S. Rideal which must not be allowed to escape the attention not only of those gas managers who are working under the sulphur clauses, but of all who are in any way interested in gas as purveyors. Gas has long rested under the infamy of polluting, in a disgraceful manner, the air of rooms; and this has been reckoned as its chief inferior quality in comparison with the other methods of lighting. All the same, gas has gone on progressing both in favour and use. This, when one is brought face to face with the fact, makes it all the more curious why nothing has until lately been done to prove the actual extent to which the imputation is true, or to exculpate gas from the calumny. At length it has been done; and, through scientific means, gas has had its reputation restored, which theorizing and unscientific methods had been successful in injuring. Of course, no one will suggest that, in a room illuminated by gas for several hours the air will remain absolutely unaffected; but that it is rendered impure to the degree that has hitherto been supposed is now declared, by experimental work of a highly efficient order, to be entirely unfounded. And what is more, although it appears to be somewhat paradoxical, it is found that the sulphur content of the air of a gas-lighted room is smaller than that of the outside air under certain conditions. Further than this, we are now told that the walls and ceilings of rooms, consisting largely of carbonate and caustic lime, act very energetically in absorbing the sulphur acids, which accounts largely for the foregoing phenomenon. Also that the sulphur content of the air of a room in which oxide-purified gas is burning is almost inappreciably greater than that of a room in which lime-purified gas is burning. These are all facts which, strange as they may appear set out in this bald fashion, are of the utmost importance to the gas industry; and their truth is certified by the two skilled and careful investigators already named.

Working in unison, Mr. Hehner and Dr. Rideal encircled their inquiry with such preparatory completeness that the verity of the results must be accepted, in the absence of anything of a controverting nature with an equally sound scientific base. And the results must not be permitted to become mildewed through want of use. In the interests of gas lighting, they should be heralded abroad, to the enlightenment of consumers and the discomfiture of the detractors of gas. Here is one particularly satisfying quotation from the report: "Under ordinary conditions, we have found not "only no increase in the sulphur content of the air of the "[gas lighted] room over that of the outside air, but we "have even found a decrease owing to the rapid purifica-"tion by the walls and the ceiling. We have also noticed "the purification of the air when no gas was burning in the "room." Then we have Mr. Hehner saying in his evidence: "We found the proportion of sulphur and carbon obtained "by the analysis of the gas was no index whatever to the "sulphur content of the room. We found in every case "the sulphur content of the atmosphere was far less, some-"times one-twentieth of what it ought to have been." And Dr. Rideal, calling attention to specific experiments, asserts that it was found that the quantity of sulphur in one of the rooms in which the tests were carried out after (40-grain) oxide-purified gas had been burning for ten hours was "about one-sixteenth that which would be obtained in the "outside air on a very foggy day." In considering the report and evidence, it must be remembered that all ordinary means of ventilation in the rooms in which the experiments were made were specially closed up, in order to obtain the worst possible conditions.

These experiments (which the evidence shows were completely governed by scientific principles and scrupulous care) are, so far as we are aware, without parallel; and there is little doubt that they contributed very largely towards enabling the Committee to come to the conclusion that they did, that there is no necessity whatever for insisting upon the continuance of lime purification. Parliamentary Committees and the public have been too long and frequently bamboozled over this sulphurous, air-contaminating bogey by experiments conducted with a crudity discreditable to scientific men; and it was high time that, by tests conducted on rational and scientific lines, the bottom was knocked out of the nonsense that has been uttered. It is due to the South Metropolitan Gas Company to say that they alone of the three London Gas Companies resolved that, cost what it might, they would know (and ultimately the Departmental Committee) the truth of the matter. The idea, we believe, originated with Sir George Livesey; but his curiosity, in the first instance, did not extend farther than the ascertaining of whether there was any appreciable difference in the sulphur of the air of two rooms—in the one case lighted with gas purified with lime, and in the other with gas purified with oxide only. While he thought there would be very little difference, it is quite safe to venture the opinion that he never imagined results such as those obtained would be forthcoming. Every gas man who desires to learn more of this matter will not fail to read the account elsewhere of the contribution which Mr. Hehner and Dr. Rideal made to the proceedings of the Committee and to our knowledge of the subject. The accident of Mr. Hehner's seniority brings him into somewhat more prominence than his collaborator in this investigation; but he, we know, would wish that Dr. Rideal (whose work was most valuable) should share equally the honours with him. Once more the South Metropolitan Gas Company have made the whole gas industry their debtors.

Coal Prices and Values.

IT has been reported that the largest gas coal contracts of the year have been placed at reductions of from 6d. to 9d. per ton on last season's prices, which were by so much lower than the figures ruling the previous year. According to this broad statement, therefore, coal values have fallen within the last two years by upwards of 1s. per ton at the pits. This is a consideration which the colliery interests of the country, which are various, would be well advised to ponder seriously. Indications are not lacking to show that neither masters nor men in this trade quite understand their own market. Recently, one of the coal trade journals pilloried itself by insulting gas managers as a body, probably through some belated recollection of an ill-conditioned snarl indulged in last year by a colliery manager who could not get so high a price for his stuff as he wanted. It does not seem to occur to those who show bad manners when the turn of the market is against them, that if illicit influences were only a fraction as powerful as some affect to believe, there would be no market variations. Vendors could get their own prices, on the usual inducement, whatever the tendency of market values. The fact that it is not so, but quite the contrary, is the best refutation of the calumny that gas coal is not bought at current values. Apart from this aspect of the subject, the fall in the prices of gas coals during the past few years, notwithstanding all the influences of every kind that have ceaselessly operated to prevent this result, must possess much meaning to all those who are interested in the subject. To begin with the national aspect of the subject, the fact of prices having fallen is good evidence that the much-discussed exhaustion of the supply has not begun to exert any real effect on the market. Secondly, it also shows that neither organizations of colliery owners nor Trade Unions among their men had any power to arrest the fall in values. Again, nothing in the contemporary state of the oil market has had the slightest apparent influence on coal. Dear coal makes dear oil; but the reverse action is not observable. There is not the smallest reason for thinking

that the depression through which the petroleum interests have passed, or are passing, is responsible to a measurable degree for the fall in coal.

The phenomenon in question is probably due to a number of causes. Prominent among these must be classed the practical supremacy of the Trade Unions, which has synchronized with an enormous increase in the collier population. Though the output per man has fallen, and the value of each man's labour is less, the attraction of the artificially enhanced rate of wages has drawn men into the trade from agriculture and similar ill-paid work. Some other influences tending to produce the same effect are recounted in the evidence submitted to the Royal Commission, and were touched upon in the speech of Sir Lees Knowles when opening the Colliery Exhibition. One is the increased attention given to the utilization of small coal, and the growing employment, in this connection, of retort coke-ovens. By the greater attention given to washing, moreover, classes of coal once regarded as unsaleable are now finding their place in the market; and various mechanical appliances for making small coal do the work of round coal are growing in favour. In short, after following what Sir Lees Knowles has to say on this aspect of the coal trade, one is irresistibly led to think that probably there is a close analogy between British cookery and the British coal interests. Both cookery and the use of coal have largely been spoilt in this country by the excellence, abundance, and cheapness of the raw materials. This is the chief reason why Continental cooks and colliery engineers have had to bring so much art to bear upon their respective labours. The British consumers have always been able to get the best, without much trouble or expense; and they have consequently ignored the waste. Sir Lees Knowles is therefore able to speak of the British manufacturers' "sentimental" predilection for round coal; and the ironmasters' unjustified fancy for the "large and "lustrous coke" of the beehive oven. European coal is frequently so bad that it needs careful preparation before any use can be made of it; and, on the other hand, the Continental populace has always been so accustomed to pay dearly for all kinds of fuel, that colliery products English people would despise have found a ready sale abroad.

British practice, however, is changing. Steam raising by means of small coal, with assistance, is becoming the rule where round coal was once purchased for the purpose as a matter of course. Coking and gasifying processes are growing in favour. The immediate effect of the change is to raise the value of "slack" and small coal of every grade, and incidentally to relieve pressure in respect of the demand for the dearer grades. Add to this the coincidence of the highest classes of gas coal being in lessened demand than of yore, when "sperm value" was the criterion, and the weakness of the gas coal market is largely accounted for. We mentioned petroleum just now. It is notoriously difficult to arrive at a trustworthy conclusion in respect of the tendency of the gas oil market; but late intelligence seems to favour the expectation that prices will rule low for some time to come.

The Duke of Northumberland's Clause.

THE settlement of the 1904 form of the Bermondsey clause is a matter of congratulation for Gas Companies and ratepayers in districts where the local authority are possessed by the mania of municipal trading. We mention the subject here for the sake of putting on record the latest phase of the restriction. It has been the lot of the Duke of Northumberland to have his name attached to a model clause which takes the place of the original Bermondsey rescript. After hearing Mr. Balfour Browne, K.C., attack the clause which he was instrumental in getting adopted by Parliament, the Duke of Northumberland's Committee felt sorely perplexed as to the rights of the matter, and they appealed to the Board of Trade (whose hostility to the clause was better known than understood) to explain the attitude of the Department. This brought up the Hon. T. H. W. Pelham, one of the Assistant-Secretaries of the Board, who maintained that the clause as originally drafted would defeat its own object, and hinted that the motive of the Gas Companies who favour the clause is the hope of crippling the electric light undertakings subject to it. This somewhat extraordinary display of Departmentalism rather failed to convince the Committee as to the excellence of its object. Indeed, the result was a distinct set-back for the Board of Trade, inasmuch as the Committee declared themselves in favour of protecting the ratepayers from loss on municipal electricity supply, while allowing the undertakings a period of grace for building up their business on a commercial basis. Three years, in the case of an established undertaking, and five years in the case of a new one, are to be the maximum periods of probation, in which it is to be tried whether a remunerative connection can be got together on rates calculated to bring about this result. Thereafter, or as soon before as the result can be realized in practice, the rates must be adjusted to ensure a balance of the revenue account and pay all charges without any burdening of the rates. And so on from time to time, at triennial intervals if not more frequently. In certain cases, by agreement, the Marylebone addition to the Bermondsey clause has also been adopted, forbidding the local authority to charge more for public lighting than the rates imposed on consumers using energy for similar purposes and for the like hours of supply. The Duke of Northumberland made no objection to this provision where it had been previously agreed between the parties; but he declined to impose it upon others. The Provisional Orders which contain this precedent are, therefore, those of Hampton Wick, Malden and Coombe, and Huddersfield, together with the Marylebone Borough Electric Lighting Act of this year. The purpose of the Duke of Northumberland's Committee, in effecting this fair and reasonable settlement of a question of several sides, is laudable; and the outcome is something of which nobody can complain. Electrical opinion is at one with our own in welcoming "what will probably be called the Duke of "Northumberland's clause;" and in trusting that it will be accepted by the House of Commons and become standard practice in the case of all Electric Lighting Orders. It is scarcely necessary to take very serious notice here of Mr. Pelham's childish slur upon Gas Companies. If this is the order of mind which rules the Department and advises the President, the sooner the President becomes a statesman of the first class, with a £5000 a year judgment, the better. It would be a bad outlook for the gas industry if its prospects depended upon the off-chance of artificially crippling, by legislative device, a half-dozen local authorities' electric lighting schemes. Besides, if Mr. Pelham knows anything of the matter at all, he must be aware that the principle of the so-called Bermondsey clause is of railway origin.

Surveyors' Criticisms of the Valuation Bill.

IT may be doubtful whether the Valuation Bill is dead, or only in a state of suspended animation; but it is at any rate certain that there is much conflict of opinion respecting its merits. In all probability, much of this is artificial, and would yield to pressure. Not much respect need be paid to those perfunctory opponents of the Bill whose attitude was taken up merely in defence of the existing system and the bodies by whom it is administered. A man who is condemned to be hanged deserves his fate if he accepts it without a protest. It is, however, quite impossible to withhold respectful attention from the considered judgment of the Council of the Surveyors' Institution, who have expressed a general approval of the Bill. The Council offer several recommendations designed to correct some of the defects of the measure as drafted. They propose, for instance, that the property of a county council or a county borough council should be valued by independent surveyors nominated by the Local Government Board. This would overcome the grave objection to entrusting such bodies with the invidious duty of valuing their own property. It is also suggested that the surveyor of taxes should be advisory only; and that the work of reassessment should be spread over the quinquennial periods, instead of having to be done simultaneously over the whole of England and Wales. Greater scope is recommended with regard to appeals. The latter are administrative details, as to which the Government would probably not prove recalcitrant. A far larger question, however, and one of principle, is raised by the Surveyors' suggestion that the net or rateable value, and not the gross value, should be the common basis for local and Imperial taxation, including the land-tax. Doubtless, if a scheme of national taxation had to be devised and put into operation from the beginning, without regard to history or past practice, there would be much to say for a single tax, to be raised on a common basis. As the matter stands, however, the gap between Imperial and local bases of assessment is too

considerable to be removed by a stroke of the pen. There is reason in the proposition to make the surveyor of taxes an advisor, instead of a dictator, as he would be, in a sense, under the Bill. The former arrangement seems more in agreement with the principle of local self-government, and would probably work with less friction. The cream of the Surveyors' counsel, however, is the independent valuation of municipal property; and it would be a pity for this to fall to the ground.

The Income-Tax and Annuities.

It was quite expected that when the House of Commons resumed the consideration of the Finance Bill, some effort would be made to obtain an expression of opinion from Government on various matters connected with income-tax. Mr. Herbert Lewis had a notice on the paper designed to raise the question of graduating the tax. These proposals were not of a very drastic order, seeing that they contemplated the establishment of a sliding-scale, in which the standard rate of taxation was 1s. in the pound, which would be chargeable in respect of incomes of from £1000 to £2000 a year. Speaking in the interests of a section of the public made up in vague proportions of investors, professional men, and persons whose means come from the profits of trades and industries, we are altogether at a loss to see how the income-tax could be graduated or differentiated without making one order pay for another. The rather small cry that investments should pay more than professional profits will scarcely hold water on examination. Really, this is already the case; because in most cases income-tax on returns from investments is paid to the uttermost farthing. To say the least, this is never the case with fluctuating or uncertain professional earnings. It is easy to overrate the stability of investments, and under-estimate the constancy of professional incomes. Over-taxation of investments in securities easily traceable, such as gas or water stocks, would, moreover, tend to frighten away capital, and possibly to increase foreign speculations. Nevertheless, it is probable that there is something in the view taken by certain people, that the incidence of income-tax on gas property and other kinds of securities may be advantageously reviewed now that the tax must be regarded as a heavy and permanent peace tax. While it was looked upon as a war tax, of varying amount, it was submitted to without the same criticism that would have undoubtedly been focussed upon a fixed charge on the sinews of enterprise. By way of illustrating the point, Mr. H. C. Gibbs has lately drawn attention to the income-tax charges on annuities issued in payment of transferred undertakings. There is a House of Lords judgment in this matter, in the case of the annuitants of the Great Indian Peninsular Railway and the Secretary of State for India, which appears to be well worthy of the attention of those concerned with annuities of the kind.

In the Workers' Behalf.

Some time since, special prominence was given in the "Journal" to the concession by the Board of the South Metropolitan Gas Company of an extra quarter of an hour to their workpeople for breakfast time; and a very forcible appeal was then made by Sir George Livesey, backed by his own men, to the managements of other gas undertakings to consider the advantages, both to themselves and to the men, of adopting the same course. The mutual character of the benefits were then undoubted by those who had had an opportunity of observing the effects. The idea fell flat at the time; but the question is reopened in our "Correspondence" columns to-day. There will be found a letter from Sir George, together with testimonials from the chief officials at all the stations of the South Metropolitan Gas Company and the works of the Crystal Palace District Gas Company, which show conclusively their unanimous satisfaction after a long trial of the additional breakfast time allowance. On this testimony, perhaps other gas companies and corporation gas committee's will feel disposed to give a little more deliberate consideration to the matter than apparently they did when the plea was first made. Concurrently with the receipt of these letters, the seventh number of the "South Metropolitan Gas Company's Co-Partnership Journal" has been published; and in it, as in the first number, we find a collection of original articles, which are both instructive and interesting. The "illuminating power" of the "Journal" is indeed being maintained at a high level, however measured. The first article, or rather address, is by the Chairman of the Company; and it is on his favourite theme of "Co-Partnership"—the occasion being the fifteenth annual distribution, which, a sub-heading informs the reader, amounts to "8¾ per cent. on salaries and wages." As near as can be estimated, Sir George says the amount to be distributed among the men this year is £32,000. This is remarkable; and what it means is driven home by a significant illustration in ten words: "This," says the writer, "would build or buy 106 houses at £300 apiece." The other opening sentences of an address full of life and earnestness are these:

"Hitherto in these annual messages I have addressed you as profit sharers. We have now grown into a Co-Partnership—a wider and better term to express the relationship of the three parties interested in the Company; but it was profit-sharing that gave the start, and was, as it should be, the stepping-stone to shareholding and all that followed. If the yearly profit-sharing bonus had been paid in cash, the greater part of it would have been spent; and instead of the magnificent total of upwards of £200,000 owned by the employees in the Company's stock and on deposit, there would have been only the 00,000's without the figure in front of them that gives them their value. There would have been no shareholding, and consequently none of that interest in the Company that is so pleasant and satisfactory a feature; Messrs. Austin, Butcher, and Drumgold, who now serve the Company with all-round advantage as Directors, would have been simple employees; and a great and valuable and successful experiment in the management of Joint-Stock Companies would not have been made."

The Price of Gas to Employees.

Co-Partnership and other benefits of a more ordinary character are not the sum of the consideration which the South Metropolitan employees receive at the hands of the Company, as is seen by another note in their "Journal." The Directors some years ago decided to let them have gas at cost price—that is, the cost of making and distributing, without any charge for interest on capital. Interest amounts to between 7d. and 8d. per 1000 cubic feet. The selling price is 2s. 1d.; therefore 1s. 6d. is as near as may be the actual cost price. Then there is the rent of the meter, and of the cooking-stove where there is one in use. If (Sir George points out to the men) these rents were not charged, the price of gas would have to be raised at least 2d. per 1000 cubic feet; and 2d. per 1000 cubic feet means something like £96,000 a year from the consumers, about £16,000 a year from the shareholders—and 1½ per cent. less bonus, or about £6000 a year from the employees. Every consumer has a meter, but all have not stoves. It is thus fair that rents should be charged. If these rents were not charged to the employees, and they had their gas at 1s. 6d., they would be getting it under cost price, which was never intended, and would be unreasonable. Therefore the employees are charged cost price for the gas and rent for meter and stove. A desire has been expressed by some of the men to change to a slot meter. This the Directors have also announced their willingness to grant; and furthermore they are prepared to make an allowance for the fittings where they belong to the tenant. The allowance on the gas is returned every half year, and that on the fittings is to be made at the same time. No wonder the men who serve under the South Metropolitan Gas Company are rarely found seeking service elsewhere.

Unreasonable Demands of Steam-Roller Users.

The now familiar injunction to "beware of the steam-roller," which has become necessary on the part of the users of that ponderous machine in order to save the limbs, and possibly the lives, of pedestrians and others who have to traverse the public thoroughfares of large towns, is one which experience has shown to be equally applicable to the occupiers of the subsoil, especially gas and water companies. It is superfluous to enlarge here upon the danger arising from the fracture of a gas-pipe in consequence of a heavy steam-roller passing over it, or to review the proceedings which have been taken to obtain protection in this respect; the actions brought by the Gaslight and Coke Company against the Vestries of two important Metropolitan parishes being within the recollection of most of our readers. In view of the decisions in these cases, one would suppose that a local authority owning

a steam-roller would be desirous of conciliating the gas company in the town by giving notice to, or conferring with, the officials when it was proposed to use it. This, however, does not appear to be the case—at all events, in an instance which has just been brought to our notice. Here the Gas Company were not informed of the intention of the Local Authority to use the steam-roller in certain streets, but were called upon to specify in detail the position of any pipes which they considered were likely to be injured by the roller, and to furnish a list of streets, and a plan showing the location of the mains and their approximate depth from the surface. This the Company naturally declined to do, not being under any legal obligation to supply such a plan. In their case it would have entailed considerable expense, seeing that the plans cover something like 86 sheets. At the same time they courteously offered to allow the officials to inspect these plans; but they ventured to suggest that they should refer to those in possession of their own Water Committee. It is not a little curious that this Local Authority have in certain cases forbidden the use of traction-engines, which, moving at a more rapid pace than steam-rollers, do much less harm; and in one case they recovered compensation from the proprietor of an engine for damage done to a road. The fact is, the injunction referred to in our opening remarks should, with a verbal addition, be taken to heart by the Local Authority in question. They should "beware of *using* the steam-roller;" in other words, they should be on their guard, when they use it, that the soil beneath the roadway over which it passes is of such a nature as to be capable of bearing its weight without damage to pipes laid therein. If they look carefully into this matter, they may find that in some cases it is rather spongy, and would give way under pressure. Indeed, it seems that the passing of the roller through one of the streets where the subsoil is of this character resulted in the immediate leakage of gas into the drains of several of the houses. Here is an element of danger which should not be ignored; and, in view of the decided cases, there would not be much difficulty in fixing the responsibility for any injury to person or property that might ensue from its presence. Under these circumstances, it seems to us that the Local Authority concerned would do well to assume a less "stand-off" attitude in regard to their relations with the Gas Company on this subject. The latter have made a perfectly reasonable request to have notice of any intention to use the roller, and to come to some agreement on this important business. As this has been refused, it will not be surprising if the Company take steps to enforce their rights in the event of any damage being done to the mains. We venture to think the Local Authority are ill-advised in taking the course they have done; but they will have to bear the responsibility of their action.

Progress at Nottingham.

Last year we were able to congratulate Mr. J. H. Brown, the Engineer and General Manager of the Nottingham Corporation Gas-Works, on the satisfactory nature of his first report to the Gas Committee. At the date to which the report was made up (March 31, 1903), Mr. Brown had only been at Nottingham for six months, and so, of course, was responsible for merely the last half of the year's working. The report which is noticed in another column to-day, however, represents a full twelve months' operations under Mr. Brown's direct supervision; and we are pleased to see that the improvements shown on the last occasion are still further emphasized in the document now before us. A further substantial reduction has been made in the capital employed per million cubic feet of gas sold; the figure now being £551, as compared with £622 two years ago; and there has at the same time been a gratifying increase in the make of gas per ton—namely, from 10,018 to 10,173 feet, or equivalent to a gain of 32 million feet. The carbonizing wages last year (2s. 4·14d. per ton, and 2·95d. per 1000 cubic feet of gas sold) were the lowest on record in the history of the undertaking; while, following on the saving of 10 per cent. effected in 1902-3, a further considerable reduction has been made in the cost of purifying. This has been secured by alterations in the method of working and the cheaper manufacture of purifying material. Though on the present occasion chemical products show considerable improvement, Mr. Brown says, in view of the now existing weakness of the market (in some cases a drop of 50 per cent. in values having been recorded), a large falling off must be anticipated during the current year; the solitary exception being phenol, which has lately risen in price owing to the war. Another satisfactory feature of the accounts is a further decrease in the percentage of unaccounted-for gas. The result of the working is that the total receipts have gone up from £343,548 to £351,462, while the expenditure has remained practically the same—£254,425 last year, as against £254,407 for 1902-3. Although on the present occasion the receipts for gas show a gross reduction of £2614, it must be pointed out that the lower prices charged were equivalent to a concession to the consumers of no less than £17,372; and the flourishing condition of the undertaking has enabled the Committee, since the close of the financial year, to make a further reduction in the price of gas for all purposes other than power. The ratepayers of Nottingham have good reason to be satisfied with the management of their gas-works.

The Presidential Address.

In the opening lines of his Presidential Address to the Western Gas Association (an epitome of which will be found elsewhere in this issue), Mr. F. H. Shelton, of Philadelphia, announced his intention of varying somewhat the lines on which such labours were usually carried out. It has been his experience that the preponderance of custom in these addresses is to describe in general terms the prosperity of the gas business, utter praise in various fashions, throw out a lot of maxims as to increasing the use of gas, plead for the greater output of gas-engines, advise the members to work diligently, and "otherwise consume about twenty pages in platitudes, reviewing, and generalities that usually are well understood and accepted already." This sort of thing is not at all in accord with Mr. Shelton's ideas; and so he proceeded to strike out another path—offering suggestions and dealing with matters from a critical standpoint, on the ground that "criticism usually provokes discussion, and discussion usually leads to some improvements," which was what he aimed at. Mr. Shelton was perhaps a little hard on the "preponderance of custom;" but, at any rate, he steered quite clear in his own address of the faults which he has perceived in those of others. What he had to say was, of course, directed chiefly to his own and some other American Gas Associations; but he had several suggestions to offer which may be taken note of outside his own country. Altogether, the address was of a really practical character, and such as to constitute ample justification for the claim that Mr. Shelton set up to his right "to preach a little." His statement that the office of President carries with it the obligation to give more than usual thought to internal matters, and a duty to point out where improvement seems possible, was shown by his subsequent remarks not to be a mere empty expression of opinion, but a conviction that had completely laid hold of him, and on which he had acted in that thorough manner which is so characteristic of our American friends.

Gas and Electricity for Power

It was, perhaps, hardly to be expected that the figures adduced by Mr. Thomas Canning, of Newport, as the result of his practical test of gas and electricity as sources of motive power (and recorded in the "JOURNAL" for the 7th ult.) would be allowed to pass entirely unchallenged; and therefore we were not greatly surprised to see that a correspondent has endeavoured in one of the local papers to improve the case for electricity. The event, however, has merely succeeded in proving the unwisdom of this course, for the letter has given Mr. Canning just such an opportunity as he might have desired for driving his facts well home. In the first place, the correspondent in question had the misfortune to base his communication on an altogether false assumption—namely, that "it is well known that gas and electricity are equal in cost where gas is 3s. per 1000 cubic feet and electricity is 6d. a unit, at which prices either agent practically means the same power cost." A better opening than this, no champion of the cause of gas could wish for; and needless to say Mr. Canning has taken full advantage of the opportunity thus rashly accorded to him. It will be remembered that the result of the test was to prove that, for doing the same amount of work each, a gas-engine required 110 cubic feet of gas, while an electric motor absorbed 4·38 units. The cost of this amount of gas, reckoned at the price of 2s. 10d. per 1000 cubic feet, was 3·74d.; while if the electricity was charged at only 1d. per unit, it would come out at 4·38d. Though Mr. Canning admits that this result may be a

surprise to the doubting correspondent, he proves that it is not unknown to electricians, by quoting an extract from the "Practical Electrician's Pocket-Book and Diary" for 1903. In this the author, comparing electric motors with gas-engines, says that where "the power required is of a steady and continuous nature, and can be applied fairly close up to the work, electrical power at current rates—anything over 1d. per unit—cannot compare in cheapness of running with an economical gas-engine."

And Lighting Purposes.

But Mr. Canning is not content with treating the question from the motive power point of view; he also shows what is the true relation to each other of gas and electricity for lighting purposes. He remarks that, even when used in an ordinary flat-flame burner, with the extravagant consumption of 6 cubic feet for 16 candles, gas at 3s. per 1000 cubic feet has been reckoned by electricians to be equal to electricity at 3d. per unit; but by means of the vast improvements made in recent years by the introduction of Welsbach burners and mantles and intensified and high-pressure gas systems, even this comparison is wholly ridiculous. Mr. Canning takes as his basis high-pressure intensified lamps, in which a 10-foot burner gives a light of 300 candle-hours, or 30,000 candles for 1000 cubic feet of gas—the cost of, which is, for the sake of argument, put at 3s. Dealing generously and giving an electric lamp the credit of 1 candle hour per $3\frac{1}{2}$ watts, there would for 30,000 candle-hours be required 105,000 watts, or 105 units, which, if taken at the price of 6d. per unit, would amount to 52s. 6d., as against the 3s. for gas, *plus* (say) 10 per cent. for installation and mantles. With the ordinary Welsbach light, without either high pressure or intensifying, Mr. Canning points out that 1000 cubic feet gives the equivalent of 12,000 candle-hours; while to secure the same result from electricity would require the absorption of 42 units, which, at 6d. per unit, would amount to 21s. Even in the old flat-flame burner, he says, 1000 cubic feet of gas has the lighting equivalent of 3400 candle-hours; and this result can only be obtained by the absorption of 11·9 units of electrical energy, which, at 6d. per unit, would amount to 5s. 11d., or practically double the cost of gas at 3s. per 1000 cubic feet. Mr. Canning is doing good service to the gas industry; and we are as pleased as his opponent must be sorry to see how ably he has exposed the hollowness of the claims of electricity to adoption on the score of relative cheapness. No matter how many times the arguments may have to be repeated, gas engineers should follow this excellent example, and make a firm resolve never to pass by unheeded the misleading statements (however absurd they may appear) that electricians and their friends seem never tired of indulging in.

The London Water Companies' Appeals to the House of Lords.—The hearing of these appeals, briefly noticed in the "JOURNAL" for the 28th ult., was continued on Tuesday, Thursday, and Friday last week; the questions argued before their Lordships bearing upon the New River Company's Clerkenwell Estate, the payment of the land-tax, and the contribution to the Chamberlain's sinking-fund. At the close of the arguments, their Lordships reserved judgment. Our report is deferred.

Gas-Engine Testing.—At a meeting of British and American Mechanical Engineers recently held at Chicago, Mr. W. P. Flint, of East Pittsburg (Penn.), gave an abstract of a paper he had prepared on "Commercial Gas-Engine Testing and a Proposed Standard of Comparison." In it, he discussed the application of friction brakes, which he considered by far the most satisfactory means of measuring the power developed. But he said that indicator cards should be taken in conjunction with brake tests, for the purpose of giving information, though it was often superfluous to calculate the power from them. For constant load tests the governor should keep the speed regular. For measuring the gas, a proved meter should be preferred; the calorimeter giving the value of the gas. It was pointed out that, though the most natural standard of comparison was the number of cubic feet of gas used per brake horse power, there was the load to be considered; and therefore the standard varied with the load. Consequently, he plotted with brake horse power as abscissæ and the cubic feet of gas (or, better still, the British thermal units) per hour as ordinates. He pointed out that the power of gas-engines of the four-stroke cycle type would vary almost in proportion to their suction displacement; and some one size of engine might be taken as a standard to which the figures obtained on other engines might be reduced. The curves thus obtained from the results of tests on many sizes of engines would be mutually comparable, and would furnish a basis for predicting what still other sizes of engines might be expected to do.

AN AMERICAN PRESIDENTIAL ADDRESS.

An interesting Presidential Address was that delivered last month by Mr. F. H. Shelton, of Philadelphia, to the Western Gas Association, at the Twenty-Seventh Annual Convention in St. Louis. Mr. Shelton (after stating that he would confine himself to a few technical questions, and discussing, and even criticizing, some Association matters) took as his first point one that was brought out by Mr. Isaac Carr at the recent meeting of the Gas Institution—namely, that in connection with the gatherings of such Associations sufficient tribute was not always paid to the memory of those who had died in the course of the year—though Mr. Carr, in his remarks, referred to the shortcomings of the Council's report in this respect (which he admitted Mr. H. E. Jones in his address had made good), while Mr. Shelton referred more to the usual style of Presidential Address. He said that the three or four minutes devoted to the memories of the departed were not enough; and that if he worked for the Association, wrote papers for it, helped to build it up, and strove earnestly to advance its interests, when he went he would want more than two lines in the Presidential Address, or a Committee hurriedly reading an obituary, so as not to miss the excursion. A feature ought to be made of bringing out at the first morning session who and what the men were who, in the preceding year, had answered a greater roll-call than that of any earthly Association, and whose face and hand-shake were gone for ever. He therefore put forward the excellent suggestion that it should be made the fixed duty of the Secretary, upon the occasion of every death, to assign to some member well knowing the deceased the melancholy duty of preparing a biographical sketch of his professional career and Association work; that this should be formally read at the meeting amid proper signs of respect; and that a resolution of sympathy and a copy of the Association's proceedings should always be sent by the Secretary to the family. Though, of course, this recommendation was intended primarily for his own Association, there is no reason why it should not be taken to heart also by others.

In dealing with the work of the Association, Mr. Shelton admitted that the chief purpose was that of gaining and exchanging knowledge; but he pointed out that, in addition to this, members often wanted to procure people and machinery. He therefore proposed a simple plan to this end—namely, that the Secretary should maintain a record of all duly reported second-hand apparatus or machinery that any members might have for sale, so that a list could be sent on (at a small charge to cover expenses) to those on the look-out for such plant. This, he thought, would quickly develop into a clearing-house of information as to gas apparatus that could be picked up cheap, to the advantage of small companies especially. The correspondence and trading would, of course, be carried on direct, so that the Association would fill only an introductory capacity, and have no responsibility whatever beyond that. A clearing-house for people could be handled on precisely the same lines. A man dissatisfied or anxious to advance could file his qualifications, &c.; and inquirers would have forwarded to them by the Secretary a list of the names in any class designated, so that correspondence could take place direct between the parties.

After remarking that there were too many Gas Associations in America, Mr. Shelton said that the principle of consolidation was now so universally recognized that any special comment in its behalf was almost unnecessary. At the present time there were nine Associations in that country, with about 2600 individual separate memberships. This involved a great expenditure of money, as well as energy, time, and labour, from the fact of each Association often thrashing out a thing on its own account that was at the same time being dealt with (or had previously been) by some other similar body. It therefore seemed to him self-evident that more or less of a consolidation or uniting of the Associations would be of benefit; and that it would be quite possible to determine a plan of union by which certain State organizations (where desirable) could continue at nominal expense as local Chapters, for commercial, political, and social, but not technical, purposes, and a common national organization could be created. One result of such a combination (with a membership of from 1500 to 2000) would be the adoption of uniform standards on behalf of gas interests at large, from the Atlantic to the Pacific; and it would also mean a gas organization, national in reality and far more powerful than ever before, or any now existing, with a solid and united front, that would be of great value in matters of legislation, franchises, taxation, and representations of the industry from time to time as occasion arose. Of course, Mr. Shelton frankly admitted that the question was a weighty one, requiring careful consideration; but with all the theoretical arguments in its favour, and the many obvious practical benefits to be derived, it certainly seemed to him the time had arrived for an earnest effort to be made for union. Before leaving this question, he made a remark which (knowing what we do of its author) renders it pretty safe to predict that more will shortly be heard of the matter in America. "Mark my words," said the President, "we will consolidate in some shape before we get through, not because we are not doing well now, but because consolidated we will do much better."

The technical portions of the address we cannot do better than reproduce in Mr. Shelton's own words. After stating that what impressed him most was how the gas business kept forging ahead,

he proceeded: Works after works report 15, 20, and 30 per cent. annual gain—and large works, too. Where does it all come from? Advertising, education, good service, liberal policy, low prices, convenience of gas—these are some of the answers. And as to equipment. Old-fashioned horizontal retorts are followed by inclines. Before they are cold, come rotary whirligig coal-projectors of exceeding attractiveness; and even while they are aborning, vertical retorts are being tried again in several countries, with high promise of success, perhaps in the near future to do away with machinery entirely. Verily, the last chapter is rarely written.

Concerning our works, there are but two questions I wish to dwell on. The first is a greater use of mechanical conveyors, or machinery to save coal and coke handling in the average works—and I mean small works. For instance, a plant running four to six benches of sixes can put in a conveyor to take coal from the spouts of a coal-bin 100 feet long, at the ground level, lift it up 25 feet, crush it to uniform size, and carry it over to the retort-house—say, 100 feet—discharging it into convenient small bins in the roof, for a round $4000. The interest on this is (say) $200. Such a plant will run over in an hour enough coal for all day into bins, whence it can be drawn, as needed, by spouts in front of each row of retorts. The interest on this investment, at 5 per cent., is $200. Will not $200 of labour a year be saved by such a rig; and even if not, is not the convenience, the capacity for the future, and the improvement of men's condition, worth that much? For coke (and for oxide also), a light, simple rig comprising dumping-buckets, carried on overhead rails of 6-inch I beams, leading out to the coke-shed, is immeasurably superior to the usual barrows or waggons on rough floor or rails, costs but little, and is well worth while, and can be amplified to any degree desired according to the size of the works. In the last two years, a good deal of study of thus handling coal and coke has convinced me that many works, and the average works, are under-equipped, are working crudely and laboriously compared with what might be, and could save money and greatly improve their convenience, economy, and quickness of working by adding small conveying rigs. On the other side, where they have been in business longer than we have, they have better learned this lesson, and have many more mechanical rigs.

My other point is a plea for better architecture in gas plants. There are too many buildings put up by mere country masons or constructors (unguided by the superintendent), who have not the remotest idea or object beyond a tight roof and sound wall. As a result, the race of plain, homely, white mortar, pilastered, corbelled brick is perpetuated, and the gas factories generally are as homely as ever. A little intelligent supervision would greatly improve this. Red mortar, instead of white, dignified lines, some curves between pilasters, instead of square panels, an ornamental key over the window and door arches, doors and windows located symmetrically, instead of hit or miss—such things scarcely add to the cost, and make a vastly better result. I recognize that in piercing out an old works conditions very often do not permit or warrant this. Yet in new detached buildings, and certainly in new plants (and there are a score a year constructed), more attention should be paid to looks. It improves the labour tone. You can brag about it to your neighbours, and get 5 or 10 per cent. better price on looks, when you combine or sell out to a syndicate.

In closing, let me add only these words: The gas business that was put out of business by the electric business, that was also made extinct by the acetylene chaps, and that has been threatened as well by various other "would be's," is a mighty lively corpse, and a pretty good business to pin to yet awhile. It has solved many troubles arising in its own operation, it has gone through troubles arising from outside, it has given vast comfort and convenience to the public. It has its problems yet to solve. The chap who perfects the gas-heater for cellar furnace work, who perfects vertical retorts, who invents a gas turbine-engine, who evolves such an equitable labour scheme as will solve the strike question, who gets us upon a uniform and fair franchise and tax basis, who gets gas from the air by a successful nitrogen process at a fraction of our present costs—each of these chaps can smoke "Perfectos" and leave fame and dollars to posterity.

And as we saw wood, to solve these problems, each with the best intelligence that has been given him, remember what the old war-horses in the business have learned, as three maxims of success, that I have found in my time so far, and that I commend to those incoming in the business: Venture to try new things; work; and play fair.

Registration of Patents.—The International Congress on the legal protection of trade, which recently met in Berlin, considered the above-named question; and the members adopted, by an overwhelming majority, a resolution moved by M. Bert, of Paris, that the privilege of priority must be claimed before the granting of the patent to which it is to apply. The concession of priority is to be cited by the original patentee in making a protest in respect of any notification of patent infringing his rights, together with the date of the original patent and the name of the country in which it was granted. Another resolution was adopted, according to which the duration of a patent on the ground of right of priority is to be reckoned from the date of notification, not from that of the notification on which the right of priority is based.

AN IDEAL GAS ASSOCIATION.

One of the most active of the gas workers of America at the present time in connection with Association matters is Mr. Henry L. Doherty, of Denver; and this accounts for his name—not from choice, but through the circumstances inseparable from activity—having of late been brought into some prominence, more especially in connection with the Question Box volume of the Ohio Gaslight Association. His latest self-imposed task has been the study of the broad question of Gas Association work—trying to solve the great problem of the constitution of the organic structure, how it should be supported, and what should be its functions and scope. Many men have concentrated their thoughts on this subject; but they have not put the issue of their meditations on paper in such a comprehensive manner as we find in a pamphlet now before us. There is no doubt that the originator of every Association that has been started has floated his scheme with the strong resolution that nothing in his day should ever stand in the way of it attaining to his own ideal of what such an organization should be. But how few such organizations have ever reached the standards specified in the minds of their projectors; or if they have reached the standard, in how many cases has its continuity been broken? The imperfections of our own Associations, the repeated essays at improvement, the difficulties of the officials in supplying constantly all that is demanded for sustaining the high level of usefulness, all furnish the proof. We do not stand alone in this repect. Even American Association work falls short of the ideal. Mr. Doherty's studies show this to be so; and so he criticizes and advises—not in the hope that his ideal will be forthwith realized, but in the hope that step by step, if nothing better can be suggested, a nearer approach may be made to what he conceives to be the proper standard. What he says, or much of it, can be applied to specialized Association work at home. It offers material from which to construct; and this material is found in the pamphlet to which allusion has been made. It is a paper ably prepared, and treating (for one man) exhaustively upon the subject; and very appropriately it was brought before the Gas Congress held at St. Louis on the 15th and 16th of last month.

We can start with Mr. Doherty from the common ground that some improvement in Association work is possible; but we cannot pass with him—interesting though the journey may be—through his investigation of Association work and possibilities from the standpoint of the conditions of the gas business and of the individuals making up the gas fraternity, though confessedly it is all germane to the subject. Mr. Doherty is picked up again where he presents his criticisms of present Association work; and he finds shortcomings in several particulars. Here (keeping to the American terms) are the defects concisely stated. The organization plan is such that sufficient funds are not provided for carrying on the work on a proper scale. Association work lacks continuity and conclusiveness. The annual convention is too prominent a feature of Association work; or rather there is little or no work done except with the convention in view as an end. The limited time at the disposal of a convention is wholly inadequate for a solution of the problems to be solved; and either the work of the convention must be supplemented or else its duration must be extended. The selection of subjects for consideration at these conventions does not reflect on the face the careful forethought that the problems deserve. It certainly must be axiomatic that, if the time is limited and only a few subjects can be considered, then those should be selected which are of the most importance to the gas business. Committee work lacks aggressiveness. It should be made plain to the members that no one should accept committee appointments unless he is willing to work; and it should be the duty of the officers of the Association to see that the committees discharge any task which they assume. Very little work has been done to secure standard apparatus and standard methods. No attempt has been made to standardize gas nomenclature, methods of testing apparatus used in gas manufacture and distribution, the sizes of coke and the names thereof, and no comprehensive effort has been made to standardize distribution records and other records of equal importance.

That is not all. No comprehensive plan has been adopted, or even essayed, for carrying on research and investigation work. Such work as has been done has been delegated to a very few men who could not work out even a major portion of our problems in a lifetime. Litigation crops up from time to time with different gas companies, especially in relation to public control, in which adverse decisions are apt to be extremely harmful and prejudicial to present properties and their future development; and no attempt has been made by the Associations to assist or advise in these litigations, which may, for lack of proper defence, result in adverse decisions involving other companies in litigation, and lessening their opportunity for successful defence owing to a precedent having already been established. There is a lack of co-operation with other engineering societies, in spite of the fact that such co-operation would be beneficial. With the exception of one State organization, no attempt has been made to co-operate with educational institutions. Yet there are a large number of schools equipped for making tests and doing all sorts of scientific work. They would be only too glad to co-operate in

the solution of many problems that gas engineers encounter; and many of the students, instructors, and professors could be directed in doing research and investigation work which would benefit the industry. Again, no attempt has been made to induce gas companies to encourage their men to do original work for the benefit of Gas Associations. No great endeavour has been made to secure voluntary contributions, and to put the Gas Associations in a position where they could discriminate in the matter that they would use in making up their programmes. There are not enough members and attendants at conventions who contribute to the proceedings. Office holding is regarded as an honour rather than as a duty.

This, in brief, shows the views of Mr. Doherty on the deficiencies of Gas Associations. Having found these, he proceeds—seeing that it is always well to have some ideal plan towards which to work—to construct his ideal Association. Disaster may follow revolution; but by evolution towards an ideal, constant and steady progress should be, or may be, made until the ideal is realized. Dealing in the same manner with what are the desirable characteristics of such an organization, it seems to Mr. Doherty that, under proper conditions, there should be one, and only one, Association of national or international character. This Association should have members from every gas company, including practically all officers and "ambition" employees, and should also embrace those men doing gas engineering work whether in connection with gas-engines or other industrial gas apparatus. This Association should have ample funds for prosecuting work for the benefit of the gas fraternity generally. The Association should have suitable and permanent headquarters. Local sections should be encouraged, and these local sections should be furnished with literature and other papers for discussions, and should be encouraged to meet frequently. Monthly meetings should be held at the headquarters of the Association and locally by the local sections. The Association should designate the subjects upon which desirable knowledge is lacking. Great efforts should be made to locate all persons capable of becoming contributors to Association work, and to encourage them to contribute. Means should be devised to encourage both study and individual improvement among the gas fraternity. Gas literature should be analyzed, classified, indexed, and revised; and, if necessary, rewritten, for the sake of putting it in more available form. The Association should devise methods for encouraging research work. Professional educators, engineers, and scientists should be made interested in the work, and, if possible, induced to contribute to the literature. The Association should define what constitutes a gas engineer, and should take steps to establish gas engineering as a recognized profession. This would certainly be an ambitious undertaking; and to many of the gas fraternity it will probably appear a foolish one.

Mr. Doherty assumes the formation of a new association which for his purpose he calls the "American Institute of Gas Engineers and Managers," and that the present Associations will be disbanded, or will become local sections of the American Institute. He also assumes that this amalgamation will not take place until the present activity which exists among the various Associations has resulted in securing membership from practically every gas company and from practically all men interested in gas engineering problems. To secure ample funds, the membership would consist of, first, gas companies, to be known as "contributing members," and the dues would be based largely on "what the traffic will bear." He further assumes that gas companies would pay annual dues of $10 each, *plus* $1 per 1000 of population served by them, up to and including 90,000; but that no company should pay anything exceeding a total fee of $100. Officers and employees of these companies would be entitled to individual membership according to classes hereinafter designated, and their yearly dues would be $5 per member. Others interested in gas engineering but not associated with a contributing company would be admitted to membership on the same terms as the officers and employees of contributing members, except that their dues would be $10 per year, instead of $5. From time to time, as the circumstances seemed to demand, divisions of membership would be made into special branches. The first division would be a technical division, which would have its own officers, who would, however, be subordinate to the general officers of the Association. This technical division would have members designated by classes.

Local sections would be encouraged, particularly where many gas companies are situated close together; and where there are large companies having enough engineers and interested employees to meet and discuss the work brought out in the other various local sections and at the meetings of the Institute—such Institute meetings being virtually the original local section meetings. To enable officers and employees of gas companies to attend the meetings, two annual conventions would be held at fixed points, or at such place as each convention might designate for the next meeting. One of these conventions would be the technical convention, in which only gas engineering problems would be taken up and considered. The other convention would preferably be a general one, where all subjects except technical and engineering matters would be considered.

The division of membership proposed is as follows: First, contributing members, being company membership. Second, general members, being advanced members not identified with the technical division. Third, associate general members, being all members who are not full general members, or who are not identified with the technical division. Fourth, technical members. Fifth, associate technical members. No distinction would be made among the contributing members; but an attempt would be made to secure representation from every gas company in the country, on the understanding that the Association would protect their investment as far as it lies within their power to do so, and assist them in every way possible. The general members would be individuals entitled to distinction, either for extraordinary proficiency in the gas business, or for active or valuable work in promoting the interests of the Association. All general members would originally be elected as associate general members, and afterwards be elected to full general membership only upon the approval of a properly constituted board. The fourth class of membership would be the technical members, who would all be originally elected as associate technical members, but might be elected to full technical membership for extraordinary proficiency in engineering or scientific work, after contributing something of value to the proceedings of the Association, and preferably along the line of original investigation or research work. The fifth class—associate technical members—would be elected to full technical membership only on evidence of proficiency in professional work and suitable contributions to the proceedings of the Institute, and on the unanimous recommendation of a properly constituted board.

Professional educators and scientists might be elected to associate technical membership, or associate general membership, without dues, and might be advanced to general membership without dues upon the same qualifications and conditions as would govern the advancement of other members. The only distinction would be that they would pay no dues; it being the expectation that these men would contribute more to the welfare of the Institute than the Institute would ever contribute to them. The condition would be imposed, however, that they would either be removed from membership at the end of the year or re-elected each year. The plan suggested for division memberships need not be dwelt on at length. The two primary objects are, first, to ensure to the Institute sufficient funds; and, secondly, to stimulate individual progress, provide for the recognition of worthy members, and encourage contributions by holding out the inducement of advancement in membership.

Then Mr. Doherty discusses the desirability of locating desired information, and of the necessity of confiding the "Question Box" to a Revision Committee in order to secure accuracy. He also advises that, in connection with the Institute, a Board should be created to stimulate, encourage, and direct research work; as well as a Literature Revision Board, who should be given ample funds for enabling them to employ competent persons for undertaking the necessary reading and indexing, and to supply to all members card indices, brought up to date, at periodical intervals. He further suggests efforts being made to stimulate original work on the part of members towards building up a complete Handbook for Gas Engineers. A Board of Awards is also proposed, to encourage contributions to the Question Box, Handbook, and investigation work by conferring suitable awards. The author also advises that the present Correspondence School of the American Gaslight Association should be placed in the hands of a Board of Directors; and, if possible, its scope and usefulness increased. Going further afield, he urges co-operation between gas engineering societies in all countries, and also co-operation among societies in other branches of engineering. A great deal of the information needed in the gas business is also needed in the other branches of engineering. The securing of this information by one technical society should suffice for all. Much of the work in engineering is common to two or more branches; and while specialization is the order of the day, yet there is, Mr. Doherty maintains, a marked tendency towards the development of a universal engineer, and universal and common engineering practice. For carrying out his aims in this direction, Mr. Doherty advocates a Board of Representatives to co-operate with the representatives of other engineering societies for the mutual advancement of all. In this way, time will be saved, by preventing the duplication of work by different bodies.

Now all this is nothing more than the essence of the parts of Mr. Doherty's paper in which he directly attacks his subject. His views are offered for what they are worth; and it may be that they will offer some suggestions for improvement on both sides of the Atlantic. The recommendations are not submitted necessarily for adoption, but rather for consideration and discussion. The introduction of a question of this character, he admits, is apt to be crude and capable of refinement. Criticism, however, will be welcomed; but it is hoped that, for the sake of progress, the criticisms of those who disagree with Mr. Doherty's views will be accompanied by concrete recommendations of better methods, and so justify the criticisms. When it is mentioned that this examination of the question of Association work occupies no less than 36 pages of printed matter (in large octavo form), it will be recognized that Mr. Doherty entered upon, and carried through, his task with a thoroughness that deserves the fullest praise. It will now be a matter of interest to learn what the gas engineers assembled at St. Louis thought of the scheme. If ever it attains its furthermost end, the designation "Utopia" should assuredly find a place in the title of the Institute. But much of that which Mr. Doherty prescribes is not beyond application if only such a unity of the gas interests as he pictures can be attained.

PRESENTATION TO MR. WILLIAM KING.

A large and representative gathering of the employees of the Liverpool United Gas Company took place at the Association Hall, Mount Pleasant, Liverpool, on Thursday evening, for the purpose of making a presentation to Mr. William King, upon his retirement from the position of Chief Engineer to the Company, after a service of 48 years. The presentation took the form of a very handsome and costly casket (a photograph of which is reproduced), together with a suitable address, from the various officials and workmen of the Company, bearing testimony to the high regard in which Mr. King has been held by his co-workers, and the unanimity which has prevailed throughout the whole staff towards their chief.

The chair was occupied by Mr. EDWARD ALLEN, who, as already mentioned in the "JOURNAL," succeeds Mr. King as Engineer to the Company; and he was accompanied on the platform by the superintendents and heads of departments—Mrs. King also being present. He commenced his remarks by reading a telegram of apology from Colonel Robinson, who was unable to be present. Continuing, he said that when it was known a few months ago that Mr. King proposed to retire, there was an immediate and spontaneous desire on the part of the officials for something to be done to show their sense of their regard and esteem for their chief, and sincere regret that he was leaving them; and the present meeting was the expression of this desire. They hoped he would carry away with him the feeling of their warm and earnest wishes for him, accompanied by their gratitude, respect, and esteem. He also trusted the memory of that evening would be a joy in the years that might be before him; and though it snapped their official connection with him, there would still remain the

It will be seen that the style of the design of the casket is Renaissance. It is oblong in shape, with the corners cut off. At each corner stands an emblematic figure—Mechanics, with the forge hammer and square; Light, holding a torch; Science and Literature, having a scroll; and Trade and Commerce, carrying the caduces. Between these figures are panels containing views—the Canal front of the works, the gas-works, and the old and new offices—the whole of which are executed in enamel. Above these is a cartouche bearing the monogram W.K., also in enamel. The cover (which is richly chased), is surmounted by the Liver Bird (the Company's badge), having the motto "*Ex fumo dare lucem*" in enamel. The casket stands on four circular feet composed of dolphins, symbolizing the maritime foundation of the prosperity and importance of the city of Liverpool. The whole is of silver, heavily gilt, and stands on a moulded plinth of fumed oak, and enclosed in a handsome morocco case lined with satin and velvet. The casket is richly lined with satin. Inside is an exquisitely illuminated scroll bearing the text of the address. At the foot of the address is a fac-simile of the signatures of the principal officials. The casket and address were specially designed and carried out by Messrs. Elkington and Co., Limited, of Liverpool.

THE PRESENTATION CASKET TO MR. WILLIAM KING.

bonds of esteem and affection. The key-note of the meeting was their love for Mr. King, and their desire that this should not be a sorrowful parting, but an opportunity of showing their loyalty to him, so that he might take this impression away into his years of retirement.

Mr. EASTLEY, one of the oldest officials of the Company, spoke of his long connection with Mr. King, whose father, he said, held the honourable distinction of being King of Gas Engineers, which position it might be said Mr. William King had well sustained as Engineer to the Company. He had always adopted the principle of even-handed justice between the Company's interests and the obligations of the public; and also between man and man in the Company's employ.

Mr. GODDEN, of the Wavertree works, and the oldest Superintendent of the Company, testified to his happy relations with his chief during the past 36 years, and thoroughly endorsed the previous speaker's remarks. He said he could not conclude without expressing his best wishes to Mrs. King, who had done so much in connection with their summer excursions and for the general welfare of the employees.

The CHAIRMAN said, in the absence of Colonel Robinson, who they expected would make the presentation, he had been requested to perform the duty; and he had very great pleasure indeed in doing so on behalf of those present, of very many who could not be there owing to their duties, and also of the whole of the staff, officials, and workmen in the employ of the Company.

Mr. KING, who was most cordially received with musical honours, said that during a long and official life he had, as they would know, met with many circumstances attended with difficulty and anxiety. But during the whole of these years of heavy responsibility, he had never had a more difficult or anxious task before him than to address those present that evening, and to express adequately his thanks, not only for the beautiful and splendid gift and address which they had presented to him, but also for the magnificent reception they had given him, which he was sure sincerely and heartily expressed the sentiments engrossed

so beautifully upon the address. Now that he was severing his active connection with them, he could not say much as to the future; but he might speak of the past. There were those present who had been in the Company's service as long as he had himself, and some but a short time; and it might be interesting to them if he gave an outline of the Company's history, which might be helpful to the younger employees. He had a little pamphlet, yellow with age, which was perhaps the oldest document connected with the history of gas lighting in Liverpool. On the first page were these words: "Rules and Regulations of the Liverpool Gas Lighting Company, made and passed at a General Meeting of the Subscribers held at the Crown Inn, Liverpool, on Friday, March 1st, 1816;" and among the original shareholders was the name of Mr. Joseph King, jun., his oldest uncle. That Company was started; and in 1818 their first Act of Parliament was obtained. Just as they had competition in later days, it was not long before the Company's success induced others to take up gas lighting. Oil-gas lighting was started, but did not succeed (there was no petroleum then), and before long it was necessary to go to Parliament to ask for the use of coal, and they got powers to make gas from any other substance. These Companies went on lighting Liverpool between them until 1847, when a third party appeared. They went to Parliament, and what did Parliament do? They said: "No; we won't have three parties ripping up the streets of Liverpool, nor even two sets of people doing it. We expect you two old Companies to amalgamate, and ask us for powers to make one Company." Now, Parliament never did a wiser thing. The promoters of the third Company disappeared, and the two Companies constituted the Liverpool United Gaslight Company; and so they had gone on until 1904, and he hoped would continue to go on prospering for many years to come. Now, what had happened? The little baby of 1816 grew to manhood, on to middle age, and perhaps a rather old age, until they had become a strong and prosperous body. An impertinent little body—Electricity—had come along who said: "We will put an end to you." Yet they had gone on increasing; and their rivals took the work for which they were well suited. He could bear testimony to the goodwill of the original Electric Lighting Company towards himself. They had not quarrelled, nor had their Company suffered in any way. In 1821, they made 23 million cubic feet of gas. When the two Companies amalgamated, they got to 453 millions. When he joined the Company, in 1856, they reached 771 millions; when his father died, and the Directors appointed him Engineer, they reached 1433 millions; and during the last 37 years they had got up to 4002 millions, and had an increase during the last twelve months equivalent to the total supply of Douglas, Isle of Man. It had not been his desire to carry out the work in the niggardliness of an Act of Parliament, but in the spirit rather than the letter of the Act. Mr. Bellamy, the Corporation Gas Tester, had stated after his innumerable tests, that the gas was over the standard the Company were obliged to give by their Act of Parliament, and that the gas of Liverpool was more severely tested than any gas in the United Kingdom. His reports on the question of pressure and purity were equally flattering. There had been no bias or favour in this matter. This satisfactory result had been brought about by the loyal support of the heads of departments, who had carried out his (the speaker's) instructions in the proper spirit; and he took this opportunity of expressing his indebtedness to them. Passing on to speak of his family history in relation to the Company, he referred to his uncle, Joseph King, who was, he believed, one of the first persons in Liverpool to start the sharebroking business. He attended the meeting on March 1, 1816, and became one of the first Directors of the Company. In 1822, his brother, Mr. John King (the speaker's uncle), became Engineer to the Company, and, as he understood, Joseph King retired from the Board at that time. Mr. John King was the Company's Engineer from 1822 to 1826, when he died suddenly at Wavertree. In the latter year, the Directors sent to London, where his father was engaged as an engineer, asking him to come to Liverpool; and he was Engineer to the Company from 1826 to 1867. At that time, he (the speaker) was Assistant-Engineer; and at the age of 28 he took up the very responsible position of Engineer, which he had held to the present time. They had had difficulties, but these had been overcome. With the combined help of the superintendents, they had never failed to give the public of Liverpool a full supply of gas up to the required standard; and he thanked all for their assistance in every department of the works. The appointment of Mr. Allen as his successor was to him one of satisfaction; and he asked all to give him their best assistance. The Directors had retained his (the speaker's) services as Consulting Engineer; and therefore, in saying good-bye, there would still be some thread of connection between the Company and himself.

Several speakers having referred in appreciative terms to Mr. King's services,

Mr. J. CARTER stated that their Hospital Saturday Fund would be increased in honour of Mr. King to the amount of 1d. per week from each man, which would largely augment the contribution to the fund.

A vote of thanks having been accorded, on the proposition of Mr. KING, seconded by Mr. TELFER, to Mr. Allen, for his services in the chair, the proceedings, which were enlivened throughout by vocal music, were brought to a close by the singing of "God Save the King."

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 58.)

THERE was a slight improvement last week in the general position of things on the Stock Exchange. The main business was the adjustment of the long nineteen-day account—a matter which was got through pretty well, although there was one small failure in the week. Speculative lines were quiet; but for high-class securities there was a cheerful tendency, and a fair demand aided by a very reasonable prospect that money will be ruling cheap for some little time to come. Towards the close, the upward movement was somewhat checked by realizations. Consols and some of the most gilt-edged class had a slight fall; but there was nothing of serious magnitude. In the Money Market, there was the usual strong demand up to the close of the half-year, after which the tension immediately relaxed; and unless something wholly unforeseen should befall us, the easy condition is likely to last. Discount rates ruled easy all through. Business in the Gas Market, which had shrunk considerably a week previously, was quieter still last week; and the closing day was almost a complete blank. The general tendency, however, was decidedly good, and though movements were neither numerous nor of large proportions, they were all in the upward direction, except in the case of one undertaking, which was influenced by special circumstances. In Gaslight and Coke issues, there were very moderate dealings in the ordinary, which showed a good healthy tone. The opening price was 93, and the closing bargain was at 94½—the best of the week; and the quotation was advanced a point. The secured issues were very quiet, but buoyant, especially the debenture stock, which had a slight further advance. A fair amount was done in South Metropolitan at unchanged figures; the range of variation being 125½-126½. In Commercials, there were several transactions in which the latest prices were well sustained. The Suburban and Provincial group showed a little more animation; but there was no movement in quotations. The Continental Companies were extremely inactive. European fully-paid advanced, in view of the approaching rise in the bonus; but Union had a fall. Tuscan debentures rose. In the remoter world, Melbourne 5 per cent. bonds were higher. In the Water Companies, there was not much business; but several stocks were marked *ex div.* The Kent Company meet to-morrow in order to agree how they shall take their compensation. The scheme for distribution of the award works out at £329 for every £100 of 10 per cent. stock. If they accept the proffered £109 10s. of 3 per cent. water stock for every £100 of money, they will secure an annuity equivalent to a perpetual dividend of over 10¾ per cent. (£10 16s. 1·836d. per cent., to be exact) upon their extinguished 10 per cent. stock—not a bad bargain surely!

The daily movements may be briefly summed up. On Monday, Continental Union fell 2. On Tuesday, Gaslight ordinary advanced 1, and ditto debenture ½. On Wednesday, European fully-paid rose ½, and Melbourne 5 per cent. 1. On Friday, East London Water 3 per cent. debenture rose 1½. On Saturday, Melbourne 5 per cent. advanced 1 more.

THE CONVERSION OF COKE DUST AND BREEZE INTO LARGE COKE.

Communicated by Mr. W. R. HERRING.

Since writing on the above topic a short time ago, some information has come to my knowledge which is of importance in substantiating and corroborating the experiments I have already made with regard to the admixture of non-bituminous matter with bituminous coal to effect the coking of the entire mass. My authority is W. Carrick Anderson, M.A., D.Sc., Lecturer on Metallurgical Chemistry and Assistant to the Professor of Chemistry, University of Glasgow, who has recently published the second edition of "The Chemistry of Coke," founded on the "Grundlagen der Koks-Chemie" of O. Simmerbach, from which the following quotations are made.

COKING POWER OF COAL.

PAGE 187.—The suitability of a coal for manufacture of metallurgical coke may be roughly gauged by the test first suggested by L. Campredon. The sample is ground sufficiently fine to pass through a sieve of 400 holes per square centimetre. It is then very intimately mixed with varying proportions of fine dry sand, and the mixture ignited in a covered platinum crucible exactly as would be done for determination of volatile matter. The character of the resulting coke is noted. The weight of the coal being taken as unity, the largest amount of sand that the sample will bear, and yet give a coherent coke, represents the coking power of the coal. The number of grms. of sand that may be thus added to 1 gramme of coal, is called the "caking index." It may vary from 0 in the case of Welsh steam coal to 16 or 17 in the case of the strong coking coals, such as yield the best quality of cokes for metallurgical purposes.

PAGE 42.—The coals which are rich in carbon and poor in gas (short flaming caking coals) give a higher yield of coke than those which are much superior in respect of caking, but give off more gas, and are

generally long flaming. Thus the coking process is more profitable, so far as yield is concerned, the nearer the caking coals stand in their properties to the anthracitic.

In consequence of this, the practice has recently been resorted to of mixing coals which are of inferior quality as regards caking, but are rich in carbon, with coals which cake well but yield a large amount of gas, in order thereby to obtain a material suitable for coking. The intimate mixture of different kinds of coal is naturally facilitated in the case of prepared coals by these being already in a finely divided condition.

Coals which cake readily and give off a large quantity of gas give, in consequence of their strong swelling up, porous cokes of low specific gravity, with weak cell-walls which are easily broken down. Those caking coals which yield little gas give dense cokes of higher specific gravity. For this reason also, it is an advantage under certain conditions, to mix the coals.

In the Semet-Solvay ovens, which, without employment of a special regenerator or air-heater, go to a very high temperature and evolve gas quickly, in consequence of which they are specially suited to the coking of lean coals, mixtures of 75 per cent. fat coal and 25 per cent. lean coal are converted into very good coke. At the Phœnix Mine in Germany, the mixture of coals used consists of 73-77 per cent. of fat coal, giving 25-26 per cent. of gas, with 23-27 per cent. of lean coal, giving 7-8 per cent. of gas, so that it contains only 20-21 per cent. of gas. At the Georgs-Marienhutte at Osnabruck, there is added to the caking coal 25 per cent. by weight of Piesberg anthracite.

So-called anthracite coke is manufactured in South Wales, according to L. N. Lukens, by mixing 60 per cent. of anthracite dust, 35 per cent. bituminous coal, and 5 per cent. of pitch. The coke obtained has the following typical composition :—

Carbon	94·63 per cent.
Hydrogen	0·30 ,,
Oxygen and nitrogen	1·48 ,,
Sulphur	0·23 ,,
Ash	3·36 ,,

The Landore Works in Pennsylvania also obtain a coke fit for use in the blast-furnace from a mixture of 50 per cent. anthracite dust and 50 per cent. bituminous coal.

From the above references, it will therefore be seen that what has been proposed to be done in the gas industry is an every-day practice in industries closely akin to our own; and while there may be some who will give more attention to the sneers and sarcasms of men whom we could have wished better from, the manager who has the commercial welfare of his company or corporation at heart will test and try and prove for himself whether or not he is able to do in his gas-works what is a common practice in oven-coke manufacture throughout the world.

The work from which the foregoing quotations have been made contains a great deal of useful information for the gas manager.

ELECTRIC LIGHTING MEMORANDA.

The Duke of Northumberland's Version of the Bermondsey Clause —The Period allowed for Development—A Municipal Electrician on His Business—Two Government Electric Lighting Bills.

THE terms of the 1904 version of the famous Bermondsey clause were settled last week by the Duke of Northumberland's Committee, as reported elsewhere, after a final struggle between Mr. Vesey Knox and Mr. Paddon. Before a settlement could be arrived at, Mr. Pelham, of the Board of Trade, was again sent for to detail the views of the Department; and he did so this time without making any gratuitous reflections on the motives of gas companies who ask for the protection of the clause. Mr. Paddon wanted the undertakers' accounts to be advertised in the newspapers; and he also sought to make them recoup themselves for initial losses, and to put upon the Board of Trade the duty of fixing the actual price of current, so as to be remunerative, in the event of the undertakers failing to observe this condition. This was too large an order for the Committee; and eventually their Lordships decided in favour of Mr. Vesey Knox, with some few amendments of small importance. This form, therefore, is henceforward to be taken as that which will be inserted, if asked for, in Local Authorities' Electric Lighting Orders. Both Mr. Paddon and Mr. Thesiger, for the Bath Gas Company, wanted to add to the clause the Marylebone restrictions upon the charges for public lighting; but this was denied except as regards the Hampton, Malden and Coombe, and Huddersfield Orders, in which cases the promoters did not object. It can hardly be said, therefore, that perfect uniformity as regards the powers of local authorities to charge for electricity supply has been attained. It is quite possible that opinions may differ as to the necessity for the Marylebone addition in every instance. There are cases, however, in which it certainly ought to be operative.

We cannot affect to be indignant at the amount of "law" now allowed, under the Duke of Northumberland's variation of the Bermondsey clause, to local authorities starting or having started electricity-supply undertakings. If an electric lighting venture is ever going to pay for itself at all, to say nothing of bringing in an actual profit, it should do this in three years. It is therefore no hardship for local authorities to pin their financial arrangements to this requirement; and no intelligent advocate of municipal trading is likely to object to it. The circumstances of the undertaking being permitted to be worked unprofitably for such a period, less than three years, as may be expedient for obtaining a connection, will in practice prove the finest possible corrective of the usual consulting electricians' rosy promises of immediate profit. There never was a municipal electricity supply scheme started on any other expectation than that of making a profit. Later on, while this anticipated profit usually shrinks to a balance on revenue account barely sufficient to provide for interest and the sinking fund, the lowness of the charges made for electricity is pointed to as constituting a justification for the municipal venture, disappointing as it may be otherwise. It is a curious reflection on the municipal form of the electric lighting industry, that the local authorities are terribly afraid of competition by "bulk" supply companies. Of course, if there were any reality in the claim for superiority of service or greater cheapness preferred by the partisans of municipal electricity, this fear of competition by the much-contemned private enterprises in question would not exist.

Some remarks on the above question by Mr. T. P. Wilmshurst, of Derby, in the course of his Presidential Address to the Incorporated Municipal Electrical Institution, are candid. He denied that "municipals" regard power companies as their natural enemies, denouncing such an impeachment as entirely wrong and somewhat unjust. On the contrary, he willingly conceded that these companies might be very useful in places where there is no municipal service of the kind; but he did not pretend for a moment that he would welcome them as competitors. How far this attitude differs from regarding such concerns as the natural enemies of "municipals" would seem to be a matter of no measurable quantity. Curiously, yet not strangely, the language of Mr. Wilmshurst in this respect is an echo of that of ordinary gas companies faced with the threatened competition of "power gas" undertakings. The ordinary electric light supplier, like the gas company, is under the obligation to serve everybody on demand, and cannot pick and choose his customers. Consequently, his prices look higher than those of the "bulk" provider, whose terms, moreover, are wholesale, and for a raw material which would require treatment on the spot to be strictly comparable with the local product. Mr. Wilmshurst frankly admits that the competition of domestic electric light is with incandescent gas, and that this is hard to meet. He recognizes that the maintenance of incandescent burners by gas companies puts a tremendous strain upon the electric light competition, and he warmly advocates a similar policy for suppliers of electricity. Nobody can object to this—certainly not the gas companies—so long as it is not done at the expense of the ratepayers. Mr. Wilmshurst confesses that the great handicap of electricity supply is the heavy capital burden for the earning capacity, which he quite frankly admits to be due to the want of cheaper and better means of storage. Like other central station engineers, Mr. Wilmshurst fancies that a motor connection will help to reduce this inconvenience; but in this impression it seems to us that he must overlook the mischief of overlapping. He claims to have on circuit a total of 250 single-phase motors, aggregating 1300 kilowatts, which is something for the gas company to think about. Nevertheless, the Derby load-factor is not very good—which, on the other hand, is a consideration for the Electricity Committee.

Mr. Bousfield's Committee on the Electric Lighting (London) Bill have reported to the House in favour of the Bill, with some amendments. It was opposed by several Metropolitan Boroughs supplying electricity. Considerable opposition is being shown to the Supply of Electricity Bill, which is a Board of Trade measure originated in the House of Lords. One of its most important provisions is that for enabling the Board of Trade to grant compulsory powers for the acquisition of lands for generating stations. The London Gas Companies have petitioned against the Bill. Local authorities in the Metropolitan area are also opposing it, because it proposes to dispense with their veto in some cases, and also removes certain electricity-supply undertakings from the operation of the compulsory purchase clauses. The Shoreditch Borough Council are organizing the opposition, on the ground that the Bill, if passed, will seriously prejudice the existing powers of Metropolitan Borough Councils in controlling electric lighting in their boroughs. Here again it is municipal dread of competition by private enterprise which is instigating this opposition. Municipal competition with private companies is, apparently, a desirable extension of municipal enterprise, where it seems likely to have any success; but the game must not be played in the opposite sense, for that would be to jeopardize the ratepayers' money. Who said that sauce for the goose is always suitable for the gander?

"The Ironmonger's Workshop."—Under this title, there has just been issued from the office of "The Ironmonger" a handbook of methods and materials for manufacturing ironmongers and workshop assistants. The author, who is an old assistant, has brought together a number of notes collected during a period of active work in shops; and in preparing them for publication he has endeavoured to keep in mind his early difficulties, and, wherever necessary, has not only given a rule, but has shown its working by examples. The contents are arranged in seven sections; the last being a collection of more than a hundred short notes for the workshop. These are followed by a glossary; and there is a useful index.

AN INQUIRY INTO THE RELATIVE COST OF ELECTRIC AND GAS POWER.

At the present juncture, trustworthy information respecting the most advantageous and economical system of generating and handling power in manufacturing works is to be made the most of wherever found. A good deal of published matter has dealt with this problem from various points of view, since it came to be rather hastily assumed, on the bare word of electricians, that electric power and driving is superior to other methods. Curiously enough, the earlier history of electric lighting advertisement has been repeated with respect to electric power, and bald assertion has taken the market by storm. The statement of interested persons, that electric power is the best for the manufacturer, has been allowed to carry the point in many instances. Latterly, however, there has been a return to reason in this regard, and, as the result, not merely gas power, but gas power provided from ordinary gas, has greatly risen in favour. Mr. W. E. Buck treats of this subject authoritatively in the "Engineer." This writer recites how the manufacturer has nowadays greater difficulty than of yore in deciding how he shall drive his machines. A few years ago, the question was simply how to arrange and connect the various shafts with reference to the engine. At present it has to be decided whether it is best to use steam, gas, or even oil in the prime mover, and how the power shall be conveyed to the tools. Mr. Buck begins to sort the heads of the problem; showing that, with the possible exception of small, compact factories, or those in which, as in cotton mills, all the machines have to run together as one, the majority of factories and works are best served by a combination of several methods. The difficulty lies in determining to what extent any one system should be utilized, as to which there is no hard-and-fast line. Mr. Buck says emphatically that caution and careful consideration are especially needed in regard to the seductive charms of electricity; quoting the best authorities to the effect that manufacturers should not be carried away by the expectation of deriving any benefit from electric power under all conditions. It may, on the contrary, prove very disappointing.

It is admitted that in this country, where power is generally produced from coal, gas is a formidable competitor of electricity, when transmission has to be made over considerable distances. Gas may be produced economically, conveyed through pipes without appreciable loss, and used to drive gas-engines wherever desired. Electricity is penalized by loss in the generator, the conductor, the transformer, and the motor. These losses, though small individually, are considerable in the aggregate, and the engine driving the generator must be more powerful than if fixed close to the work and the gas conveyed to it by a pipe. Thus, suppose it to be a question of delivering 100 effective horse power to a machine or department some hundreds of yards off. With electric transmission, it would be necessary to put down an engine of at least 130 brake horse power, or deliver this amount to the electric generator. Whereas a gas-engine, driving the work direct, need only brake 100-horse power, and will consume proportionately less gas. The capital outlay on the electric system would be about three times that required for gas, according to Mr. Buck. For still shorter distances—say up to 100 feet—ropes and belts are more efficient and cheaper still. One of the most difficult problems to solve in works is that of grouping or single driving. Except under special circumstances, electricians admit that it does not pay to drive machines independently by separate motors, when such machines are close together, or unless each takes 3½-horse power. For smaller tools, the first cost of motors and the interest thereon outweigh any other advantages. Where tools are only wanted at irregular intervals, and at other times are running idly, improved grouping will show economy, quite irrespective of any systems of driving. As generally happens when novelties are introduced, every benefit is ascribed to the novelty itself—say, in this case, electric driving—whereas most of it may really be due to improved arrangement. It is admitted that the flexibility of electric power is one of its chief advantages; and this is especially valuable where work is very scattered, or the buildings are badly arranged. Works extensions are more conveniently managed where the electric drive has superseded shafting.

On the other hand, if works are properly laid out in the first instance, the shafting can be driven all over the place for a small expenditure of power. The chief loss is in the ropes and belts, and through the low efficiency of small tools. After considering a number of typical cases, including electricity generated from a main gas-engine as compared with rope transmission from the same source of power, Mr. Buck gives the preference to group driving mechanically from separate gas-engines, using ordinary coal gas, not exceeding 30-horse power apiece. The total cost, with gas charged at 2s. per 1000 cubic feet, and an average demand for about 100-horse power, amounts in actual practice to about £580 a year. For a central engine with mechanical drive, the cost would be £622 per annum; and for the same with electric drive, approximately, £772. Considering power distribution in works alone, without regard to the prime mover, it is shown that in average cases there is no economy in running an electric as compared with mechanical systems of belts or ropes; while the initial cost of the two is as 4 : 1. Consequently, very great indirect advantages are necessary to justify the adoption of electricity. Another economy of the smaller, separate class of gas-engines lies in the fact that they can be started and attended to by a man who is doing other work. A central gas-engine with producer would certainly necessitate an extra man for the engine and the motors—possibly two. The same item of expense applies to steam. The partial abolition of overhead pulleys and belts is claimed as a peculiar advantage of electric driving; but Mr. Buck points out that a large proportion of these appertain to the countershafts, which are practically necessary with any system. Electricity will not banish them, inasmuch as it is inadmissible for small tools, as already shown, where the individual power required is less than 3½ brake horse power. Moreover, electric power is troublesome for variable speeds. Summarizing, Mr. Buck gives gas the preference for power transmission to medium distances, for grouped tools, intermittent or overtime working, reliability and stand-by plant, and cheapness. The convenience and cleanliness do not show much difference, if properly designed and attended to. Electricity is to be preferred for heavy, isolated tools and cranes. Requirements for adding machines, or extensions, are most conveniently managed with electricity, unless the additions are likely to be straightforward, and can be arranged for beforehand. Measurement of power is best done electrically. This appears to be a fair summary and statement of relative advantages, the net result of which is a great preponderance of testimony in favour of power derived from separate engines using ordinary gas.

STRIKES AND LOCK-OUTS IN 1903.

We have received from the Controller-General of the Commercial, Labour, and Statistical Department of the Board of Trade (Mr. H. Llewellyn Smith, C.B.), the annual report of the Labour Department on the strikes and lock-outs in the past year. According to the summary of the contents by Mr. A. Wilson Fox, C.B., the year was, on the whole, comparatively free from industrial stoppages. For some years past the number of disputes has been steadily decreasing, and in 1903 there were only 387—the average for the five years 1898-1902 being 632, and for the five years 1893-1897 816. The number of persons affected and the aggregate number of working days lost in 1903 were less than in any year for which figures have been recorded. The total number of workpeople involved in the 387 new disputes in 1903 was 117,000, or about 1 per cent. of the industrial population of the United Kingdom, exclusive of agricultural labourers and seamen. The disputes, new and old, in progress during the year resulted in the loss of about 2,300,000 working days; nearly three-fifths of this total being accounted for by disputes in the mining and quarrying industries. The amount of working time lost, if spread over the whole industrial population, amounted to less than one-fourth of a day per head during the year. In the five years 1898-1902, the average annual number of workpeople affected was 212,000, and the average duration of disputes was 5,716,000 days. In the five years 1893-1897, the corresponding averages for workpeople affected were 330,000, and for the duration of disputes 11,962,000 days. It is satisfactory to note that the decrease in the amount of industrial disturbances due to strikes and lock-outs has continued during the first part of the present year. The results of the disputes of the past year were, on the whole, distinctly in favour of the employers.

WATER AND GAS INVESTMENTS.

From the Water and Gas Securities Exchange, Limited (which has been established for the purpose of affording facilities for obtaining information about, and dealing in, water and gas securities), we have received a copy of a volume which contains a large amount of creditable matter in reference to water and gas stocks and shares. The contents of the book take a wide range, and are most informative. Their perusal satisfies one that the matter and figures are the work of someone well acquainted with his subject; and that is satisfactory so far as it goes. "It seems anomalous," says the writer in his introduction, "but it is nevertheless a fact, that, except in the case of the more important of the London and Provincial Water and Gas Companies, no official Stock Exchange quotations are at present obtainable of the prices of these securities for the information of investors." This is true, but the cause is not far to seek. Gas and water stocks are, as a rule, purchased only for investment, and not for speculation; and in numerous companies transactions in stocks and shares are rare after they are once secured. That this is so has been realized by us frequently in connection with our Stock and Share List. On several occasions important companies have been removed from the list, for the sole reason that the intermittent character of the transactions, and their smallness, removed all value from the quotations, and more often than not it was found the prices bore no relation to the figures obtainable on fresh issues of the stock. However, the book is a useful one; but it would assist public confidence to know who are at the head of the Water and Gas Securities Exchange, Limited. This can, of course, be found

out at Somerset House; but it is not convenient for the public to have to make a preliminary investigation of this sort. The only things that the book before us tells the reader about the Exchange is that it has been established with an "authorized" capital of £1,000,000, and its objects. All communications are to be addressed to the "Joint Managers," but even their names are not disclosed. It would certainly be to the advantage of the concern if its direction would give what is so desirable in financial enterprises of this kind—some indication of its stability.

PERSONAL.

The death of Sir Frederick Bramwell having caused a vacancy in the chairmanship of the East Surrey Water Company, the question naturally arose of appointing a successor. The Deputy-Chairman (Sir Myles Fenton, J.P.), not being desirous of adding to his engagements, declined the position; and upon his motion Mr. PETER RIDDOCH was unanimously elected to fill it. A further change is about to take place in connection with the management of the Company; Mr. J. RATHBONE DOWNES, the Engineer, Manager, and Secretary, having announced his intention of retiring, after a service of thirty-six years.

In the "JOURNAL" last week, we recorded the appointment of Mr. W. B. BRYAN, M.Inst.C.E., as Chief Engineer of the Metropolitan Water Board. We are pleased to be in a position to give to-day a short sketch of Mr. Bryan's professional career, which, it will be seen, has been productive of varied and valuable experience. He entered the Engineer's Department of the Nottingham Corporation in 1863, and was subsequently articled to Mr. M. Ogle Tarbotton, M.Inst.C.E., F.G.S., who was then the Gas and Water Engineer to the Corporation. He was appointed Assistant-Engineer in 1870, and also Assistant-Engineer to the Nottingham and Leen Valley Sewerage Board. Three years later, he obtained the appointment of Borough Engineer and Surveyor of Burnley, which position he resigned early in 1876, but continued his connection with the Corporation as Consulting Engineer to the Sewerage Committee until the year 1878. In December, 1875, he became Borough and Water Engineer of Blackburn; and in April, 1882, he resigned the former post, but retained that of Water Engineer until 1885. He has been Consulting Water Engineer to the Corporation on a number of occasions since then, and up to the present time. Mr. Bryan was appointed Engineer to the East London Water Company in April, 1882; so that he was with them rather more than twenty-two years. Since 1897 he has been Consulting Water Engineer to the City of Nottingham.

The Paris Turbine Retort Charging and Discharging Machines at Beckton.—We are informed that these machines are now working in regular shift-work. The speed of charging and discharging exceeds even that of the machines at Paris; the English machines occupying only some 15 seconds to charge a 20-feet retort with 6 cwt. of coal, and only 11 seconds to discharge the coke.

Rapid Roof Building.—Large roof work is frequently required in these days of extensive buildings—such as retort-houses, coal-stores, and so forth—that modern expansions of the gas business have made necessary. In some recent types of gas-works roofs, the similarity between them and railway station roof work has been noted; and therefore it is not out of place here to direct attention to a smart piece of large roof work which Messrs. Graham, Morton, and Co., Limited, have just lately brought to an end at the Central Station, Leeds, and which adds another stone to that pile of records which they are fast building up. The work consisted of the building of a complete new arcade (giving a new platform) and the roofing-in of the whole of the platforms, which had to be extended. The material required was: Number of principals, 26; columns, 36; cantilevers, 36; and lattice girders, 15—the total weight of the ironwork being 118 tons. The number of panes of glass was 462; and the area covered by glass was 5800 square feet. The working area of the station and platform covered was 28,700 feet; the area of Vieille Montagne zinc used for covering was approximately 12,500 square feet; and the area of the tongued and grooved match-boarding used was 15,500 square feet. In addition to the large purlins, timber framework, special canopies, and special mouldings were used in the construction of the roof. This is sufficient to show that the "job" was not a light one; and nine weeks and three days was the time allowed for carrying out the work. But events proved that this was not the time the firm needed. Operations were commenced on May 25. The erection of the ironwork was begun on Saturday night, June 4; and by 6 a.m. on Monday the first section of the work necessary to the carrying out of the first part of the contract was completed. The second part of the contract was commenced on Saturday night, June 11; and by noon on the following day the last piece of ironwork was lifted into position. The total number of working hours was therefore 42. Reckoning from the time the erectors entered upon the ground—the night of June 4—the whole of the work was completed in sixteen days, without the slightest disorganization of traffic. Messrs. Graham, Morton, and Co. are making themselves seen and felt in other branches of engineering than that of the gas industry.

THE SOUTHERN DISTRICT ASSOCIATION OF GAS MANAGERS AT READING.

The Question of Affiliation.

The members of the Southern District Association of Gas Engineers and Managers had a very successful and pleasant meeting last Thursday at Reading; receiving throughout the day the warm hospitality of the Directors of the Reading Gas Company, whose Engineer and Manager, Mr. Douglas H. Helps, is President of the Association. The party travelled from Paddington at 9.45 a.m., and on arrival at Reading walked to the gas-works at King's Road—passing on the way through the public gardens and the Abbey ruins, some of the leading features of which were explained by Dr. Hurry, one of the Directors of the Company, who has written a valuable book on the subject. At the works the visitors were welcomed by Mr. John Okey Taylor, J.P., the Chairman of the Company, wonderfully alert and active despite his advanced age. The Company have benefited by Mr. Taylor's statesmanship ever since 1855, when he first became a Director of what was at the time the younger of the two competing Reading gas undertakings, which were amalgamated under his chairmanship in 1862. Mr. Taylor was indefatigable in doing the honours of the works to the visitors; and he took especial pride in explaining the plans of the new offices which the Company are building in the main street of the town. Mr. Douglas Helps had thoughtfully prepared a pamphlet describing the works, which are generally known to British gas engineers through the visit of the Institution of Gas Engineers in 1894. From this description we have prepared the following abstract account of the principal characteristics of this fine station. The pamphlet omitted to state, however, what was apparent on inspection—that the carbonizing returns are second to none in the country.

READING AND ITS GAS SUPPLY.

Coal gas appears to have been first supplied in Reading in the year 1819 by a private Company whose works were situated in the centre of the town—viz., in Bridge Street. In 1836, this Company was incorporated under an Act of Parliament, with powers to raise a total capital of £20,000, and to borrow a further £5000 on mortgage. In the same year, an opposition Company was incorporated under the name of the "Union Gas Company," and authorized to raise capital to the extent of £10,000, and to borrow £5000 on mortgage. This latter Company built works near the King's Road, on a site opposite the existing offices, and on a portion of which the present governor house now stands. In the year 1862, the competing bodies amalgamated, and were incorporated under an Act giving capital powers to the extent of £40,000.

The present Chairman, Mr. J. Okey Taylor, joined the Board of the Reading Union Gas Company in the year 1855, and was elected its Chairman in 1857; and when the amalgamation took place under the Act of 1862, he was elected Chairman of the new Company, which position he has held ever since.

For some time after the amalgamation, gas was manufactured at both works—that is to say, at the works situated at Bridge Street and also at those near King's Road. Eventually, however, the whole of the gas was made at the latter works, which were enlarged to the designs of the late Mr. R. P. Spice. By the Reading Gas Act of 1880, the Company were authorized, *inter alia*, to purchase the present site.

The new works were commenced in the year 1881, to the designs of Mr. Edward Baker, who was then the Engineer. The first section was completed in the year 1887. As will be seen from the plan, the site upon which the works stand is triangular in shape, and contains about 13 acres of land. It is bounded on the north by the South Eastern, the London and South Western, and the Great Western Railways (which are connected to the works by high and low level sidings), and on the south-east by the River Kennet, which joins the River Thames just below the east end of the site. The land was formerly a portion of a large meadow named the "King's Mead," and was subject to the winter floods of both rivers, so that it was found necessary to raise its surface to ensure the level being well above the flood-line.

The retort-house and coal-store is 296 feet long by 112 feet wide between the walls. There are two retort-stacks, each containing eleven settings of eight ⌂-shaped brick retorts, 22 in. by 16 in. by 20 ft. long. The settings are on the regenerative system and are of the Klonne type. Each setting has separate hydraulic mains fitted with regulating seal valves and glass inspection chambers. The coal is weighed on its entrance to the retort-house, and the trucks are lifted on end by steam machinery and emptied directly into the coal-breakers. The retorts are drawn and charged by means of West's manual machinery; but at the present time new continuous overhead coal-storage hoppers and conveyors are being erected to be worked in conjunction with the existing coal-elevators and with the De Brouwer patent coal-projector, which will shortly be brought into operation.

On the retort-house walls there is 338 feet of 18-inch steel, and 825 feet run of 18-inch cast-iron condensing mains. From the retort-house the gas passes through a 20-inch main to one of Morris and Cutler's water-tube condensers, and from there to the exhauster-house.

There are three of Beale's exhausters, driven by Gwynne's

vertical engines. The capacities of the former are 45,000, 63,000, and 84,000 cubic feet per hour respectively.

After leaving the exhausters, the gas passes through three Livesey washers, two tower scrubbers, and one of Kirkham, Hulett, and Chandler's patent washer-scrubbers.

The purifiers are eight in number, three of them being 28 feet by 26 feet, and five being 28 feet by 28 feet. Lime is used in seven of these, and the eighth is charged with oxide of iron.

The Reading Gas Company's Act of Parliament states that the gas shall not contain more than 20 grains of sulphur in any form in 100 cubic feet. Seeing, however, that the recent Board of Trade Departmental Committee's report on the testing of London gas recommends that the legal test for sulphur compounds other than sulphuretted hydrogen be abolished, it is hoped that one day the use of lime for purification will be discontinued. The Reading gas, as supplied at the present time, only contains from 5 to 10 grains of sulphur in about 23,000 grains of gas, or (say) from 0·025 to 0·05 per cent.

From the purifiers the gas passes to the meter-house, which contains two of Parkinson and Cowan's station meters, each of 60,000 cubic feet capacity.

There are four gasholders of the following capacity: No. 1, 150,000 cubic feet; No. 2, 338,000 cubic feet; No. 3, 738,000 cubic feet; and No. 4, 1,100,000 cubic feet.

A new governor-house (with a large gas distributing cylinder and two new governors by Parkinson and Cowan) has recently been erected near the entrance to the works. Provision has been made both in the cylinder connections and also in the governor house for future extensions.

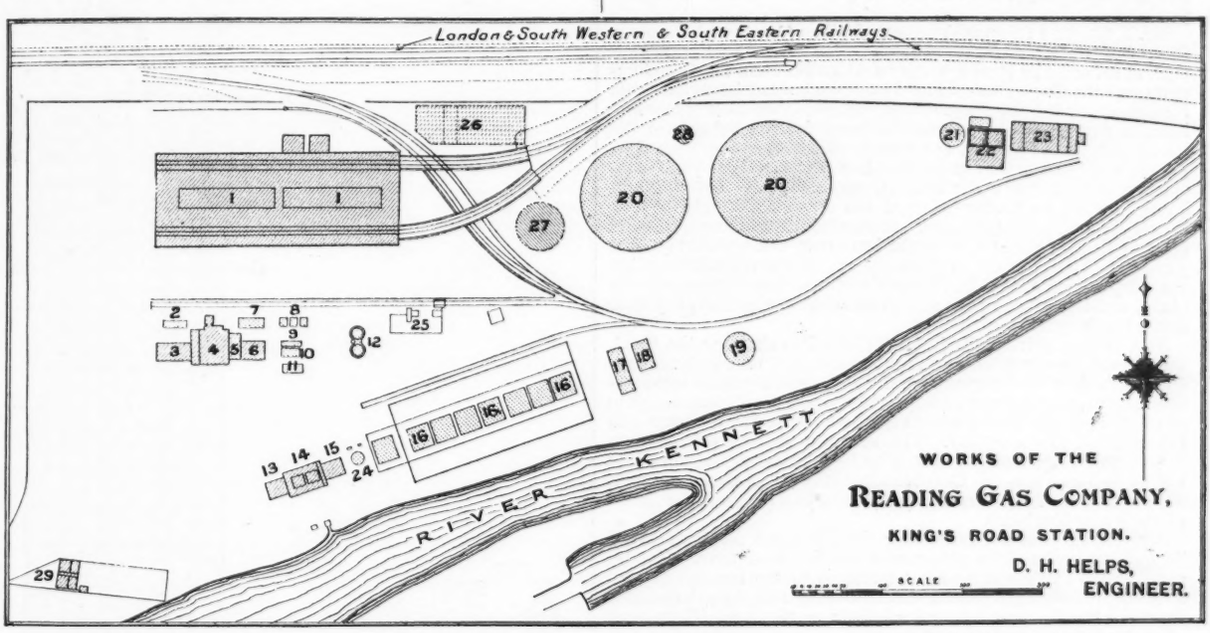
The apparatus for the sulphate of ammonia plant was erected by Messrs. C. & W. Walker in the year 1893, and was designed to distil 55 tons of liquor per 24 hours. It comprises the following: Free and fixed ammonia stills, 5 ft. 6 in. diameter by 9 ft. 6 in. high; baffle box; acid catch box; rolled lead saturator, 5 ft. long by 4 ft. 9 in. wide by 4 ft. 1½ in. deep; with lime mixer and the usual acid and liquor tanks, boilers, pumps, &c. The waste gases from the saturator are passed through large brick purifiers filled with oxide of iron.

The Company possess a complete coal-testing plant arranged as follows: The ascension pipe from one of the centre retorts in the large retort-house is valved off, and a connection taken from it (the ascension pipe) to the small experimental works, which consist of a purifier, scrubber, gasholder, and photometer.

It was not until March, 1902, that the Company commenced to supply gas to consumers through prepayment meters; but since that date over 5000 houses have been fitted up under the system.

The following shows the increase in the Company's business:—

Year.	Tons of Coal Carbonized.	Gas Made. Cubic Feet.	Capital Expended.
1863-4 . . . . about	4,000	38,000,000	£47,655
1872	9,522	101,215,000	£74,217
1882	16,810	182,716,000	£123,797
1892	26,101	299,994,000	£183,879
1902	37,747	431,087,000	£237,730
1903	40,512	477,220,000	£259,654



1. Retort House.
2. Condenser.
3. Engine Room.
4. Boiler House.
5. Dynamo.
6. Pump House.
7. Tar and Liquor Tank.
8. Washers.
9. Liquor Tank.
10. Washer Scrubber.
11. Liquor Tank.
12. Tower Scrubbers.
13. Experimental Room.
14. Meter House.
15. Laboratory.
16. Purifiers.
17. Fitters' Shop.
18. Smiths' Shop.
19. Tar Tank.
20. Gasholders.
21. Liquor Tank.
22. Purifiers.
23. Sulphate of Ammonia Works.
24. Coal Testing Plant.
25. Coke Breaker.
26. Site for Oil Gas Plant.
27. Site for Relief Holder.
28. Site for Oil Tank.
29. Foreman's House.

Luncheon was provided by the Directors in a marquee on the works, and the opportunity was subsequently taken to transact the only formal business of the day.

The Affiliation Question.

Before the toast list was proceeded with, the Hon. Secretary (Mr. James W. Helps) remarked that the members would have noticed on their programmes that a letter had been received from Mr. Dunn, the Secretary of the Institution of Gas Engineers, with regard to the question of affiliation.* The matter was brought before the Association some months ago, and no doubt they had all had plenty of time to digest it. He thought, therefore, that all that was necessary was to put the question to the vote, so that they could send an early answer to the Institution, and arrangements might be made for carrying out the idea.

Mr. E. T. D. Sapey (Horsham) moved a resolution in favour of the affiliation proposals.

Mr. H. E. Jones, in seconding the motion, said there never was a crisis in the history of gas when it was more necessary that the members should declare their allegiance to this federation, and thus combine themselves, in one broad catholic and professional spirit, in one Association, as representing the gas interest of the country. This idea had been already accepted in the heartiest spirit by three of the most important branches, or local Associations, in the kingdom.

The motion was carried *nem. con.*

The Association and their Hosts.

The Royal toast having then been honoured,

Mr. Okey Taylor proposed—"The Southern District Association of Gas Engineers and Managers," and expressed the pleasure the Directors of the Reading Gas Company felt at seeing so numerous an attendance of the members. He said it showed that their Engineer and Manager (Mr. Douglas H. Helps), who had the honour of being President of the Association for the year, was esteemed in a very high degree. Mr. Helps had only been with them at Reading a comparatively short time; but he (Mr. Taylor) was quite sure he was expressing the views of his colleagues on the Board of Directors in saying that they considered him to be a very valuable officer, and they looked forward to extending their business very largely during the next few years. About twenty-five years ago, many people thought that gas had had its day, and that the electric light would be the light of the future. A good many weak-minded people parted with their shares—causing a considerable depreciation in the value of gas property as a whole. Great credit was due to those connected

* See "Journal" for April 26, p. 219.

with the gas interest for having brought them through that time of emergency; and there was probably never a period in the history of gas companies where they stood on a more stable foundation than at the present time. Mr. Taylor paid a high tribute to the services rendered to the Association by Sir George Livesey, Mr. Jones, and their Hon. Secretary; and he went on to speak of the advanced position of Germany and Continental countries in the matter of introducing improvements in gas manufacture. He said he felt, as an Englishman, somewhat humiliated that at Reading they had to resort to Germany for the plans and specifications and the erection of their carbonizing department, as he would rather see some good old English names connected with such improvements. He therefore recognized as of great value the remarks recently made by Mr. Jones as to the necessity of giving their young men entering the gas industry a thorough technical training. If this were done, they would not find themselves in any way behind other countries. He was sure that the Directors would do anything in their power to promote this end. He coupled with the toast the name of the Company's excellent officer and their President, Mr. Douglas H. Helps.

Mr. HELPS, in reply, said that the Southern District Association was second to none in the good work it did on behalf of the gas industry, which represented a capital of over £115,000,000. It was a business very closely allied to the industrial life of the country. The steam-engine was dying, and gas was becoming more and more the motive power. Considering that, generally speaking, there was only one gas manager in any town, such an Association as theirs was very useful, in order that gas engineers and managers might meet to discuss questions of interest to their profession.

Mr. T. GLOVER (Norwich) proposed "The Mayor and Corporation of Reading and other visitors." He said it was important that, in a town like Reading, the relations between the Gas Company and the Corporation should be of an harmonious character. He congratulated the Mayor and Corporation on having recently made a new contract with the Company for the lighting of the town; and he did so with the greater pleasure, because the Corporation of the city he represented had placed a three-years contract on similar lines with the Gas Company there. He congratulated Reading on having adopted the incandescent gas system, if only for economical reasons. If they had decided on a wasteful electric lighting scheme, it would have cost them probably from £1200 to £1500, instead of £600, a year. It was a good thing that the Corporation should be in touch with the Gas Company in the place, and that the citizens should know what the Company were doing for the public.

The MAYOR (Mr. G. R. Jackson), in acknowledging the toast, said it was true that the Corporation had just renewed the contract with the Gas Company for the lighting of the town by incandescent gas, and the work had been proceeded with far enough to enable him to say that it was to the satisfaction of the town and the credit of the Company. The contract was not entered into before they compared the cost of an installation of electric light; but he declared that the Corporation did the right thing in accepting the tender of the Gas Company, who had reason to be proud of their new Engineer.

Mr. H. E. JONES, in thanking the Directors for their lavish hospitality, spoke of the progress of the Gas Company. He also thanked the Chairman for his remarks as to the necessity of instructing the younger generation connected with the gas industry in the scientific development of their profession. They were alive to this necessity; and he trusted that the Reading Gas Company, and all other enlightened companies, would help them in their appeal for funds to enable them to equip laboratories and employ scientists in order to train their young men in various centres—London, Manchester, Glasgow, Dublin, and elsewhere—so that their minds would be developed, and they would carry on from them the glorious inheritance that would be left. It was to the young men who had leisure to devote to the study of these problems that they must look for the improvements of the future. The gas managers and engineers of to-day had too much to attend to to be able to give their time to scientific study and experiments for improvements. The gas interest had been threatened with extinction by some people owing to the introduction of the electric light; but with the inventions of Dr. Welsbach and others, the prospects of the gas interest were more favourable now than ever they were. They had, in fact, the whole thing undoubtedly in their hands.

The CHAIRMAN, in reply, said that the Reading Gas Company had never had such a successful time as during the past two years. The current was in their favour, and they had only to keep up to the present standard, improving that standard where possible, to hold their own. He contended that if a company had a man of tried ability, the question of salary should be of no consideration.

THE EXCURSION.

After luncheon the members embarked on the steam-launch "River Queen," and proceeded down the river as far as Taplow. Through the kindness of the Directors of the Reading Gas Company, tea and other refreshments were provided on board. The weather was everything that could be desired for a thorough enjoyment of the trip; and it proved a delightful conclusion to the day's proceedings,

THE WOODALL-DUCKHAM VERTICAL RETORT.

Among the specifications issued last week by the Patent Office, was one to which considerable interest attaches, as it contains the first published information regarding the arrangement of vertical retort that has been under process of trial at the Bournemouth Gas-Works for some months past. It is the joint invention of Mr. Harold W. Woodall, the Engineer of the Company, and Mr. A. M'D. Duckham.

The patentees point out that their invention has for its object the continuous production in one retort of coal gas and water gas; the continuous carbonization of coal for the production of coal gas being carried on in the retort simultaneously with the manufacture of water gas, which latter is enriched to some extent by the hydrocarbons that would otherwise be deposited in the production of the coal gas.

In carrying out this invention, a substantially vertical retort is employed, into the top of which the coal is continuously charged, and from the bottom of which the coke is continuously removed; the speed at which the coal is distilled and passing through the retort being regulated according to the nature of coal under treatment, the heat of the retort, and the quality and quantity of gas required. The retort is preferably heated in such a manner

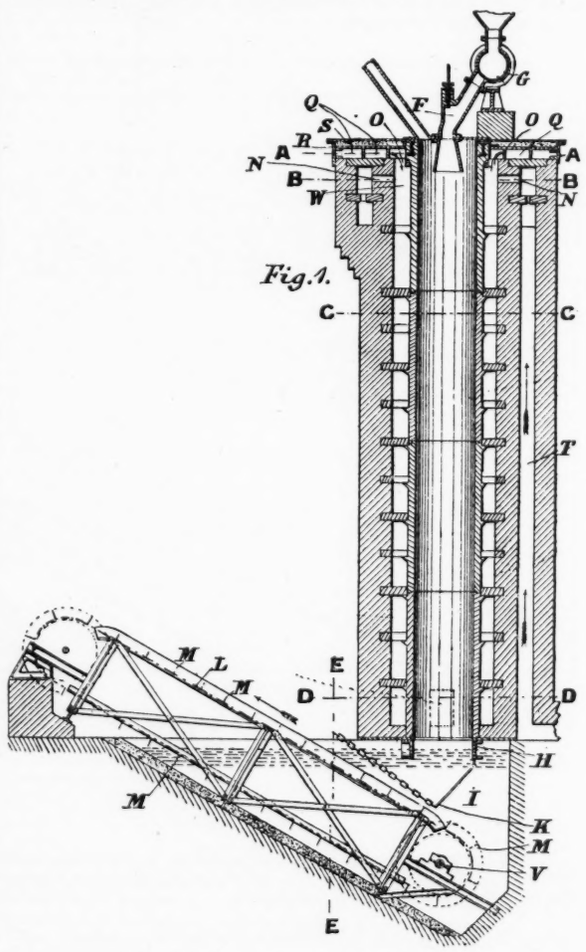


Fig. 1.

that the greatest intensity of heat is about the top of the column of coal, "which thus becomes the zone of most active destructive distillation."

The destructive distillation of coal in vertical retorts is already known, the inventors point out; but as practised hitherto the process has always been intermittent, so that it shared all the disadvantages of other intermittent retorts—namely, the considerable loss of heat in the quenching of the coke, the loss of gas and heat in opening the retorts for drawing and charging, the great variation in the volume of gas given at any one time during the process of destructive distillation, and the large amount of labour needed to work the system. Moreover, vertical retorts have been heated to the same temperature throughout, and have been partly or entirely charged with coal at one time; so that not only is a very large amount of heat needed to distil the whole of the charge, but also a very large volume of gas is given off at one time, most of which has to travel up through the coal, and in close proximity to the heated retort for a considerable distance, which thus becomes overheated and cracked. Also, in cases where

continuous working has been tried, there has been no method of ensuring that the retort will always remain full and the charge at a constant level.

By the present invention, these disadvantages in the use of the vertical retort are claimed to be overcome; for the coal is fed continuously into the top of the retort, and passes by gravity through it —issuing into a water-seal as coke, which is removed by a conveyor. The gases which are to heat the retort are burnt in flues surrounding the top; so that the coal enters the retort at the hottest place, and most of the gas in the coal is given off at once and passes away from the retort. The products of combustion from the upper flues pass down other flues surrounding the middle and lower parts of the retort—thus heating them, and causing the completion of the distillation of the coal and the formation of water gas, as well as obtaining the best duty from the gases used

Fig. 2.

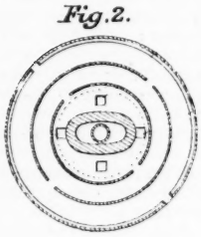


Fig. 3.

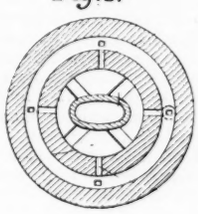


Fig. 5.

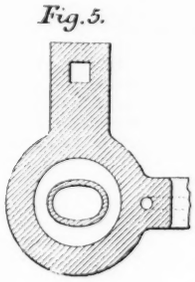


Fig. 4.

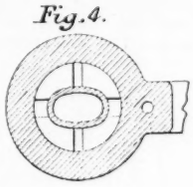
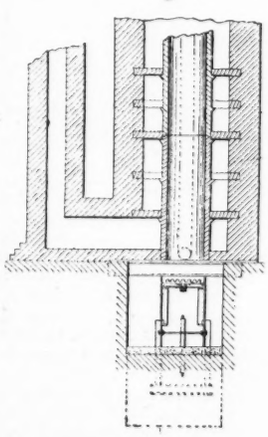


Fig. 6.



to heat the retort. The coke on issuing from the retort enters a sump, containing water, and forming a water-seal to the retort; the steam generated by the quenching of the coke entering the retort and making water gas in the lower portions.

The invention is illustrated by two sheets of drawings. Fig. 1 is a vertical section of the retort and conveyor for removing the coke from it. Fig. 2 is a sectional plan on the line A A of fig. 1. Fig. 3 is a sectional plan on the line B B. Fig. 4 is a sectional plan on the line C C. Fig. 5 is a sectional plan on the line D D. Fig. 6 is a sectional elevation of the lower part of the retort and conveyor on the line E E.

The retort (of any suitable material, set in brickwork, and surrounded by flues) is by preference oval in cross section, and slightly conical—being larger at the bottom than at the top, so as to prevent the coal from sticking and to facilitate the discharge of the coke. The upper end of the retort is closed by a cast-iron plate, which carries one or more pipes for conducting the products of combustion to the usual purifying and other apparatus. The shoot F, through which the coal enters the retort from the feeding device G, passes through the top plate and extends a short distance into the retort, which above the shoot may be enlarged if desired to allow of the gas being taken away quickly.

The bottom of the retort is open, but has a cast-iron extension H, which dips beneath the surface of the water in the sump I, forming a water-seal of any desired depth. The extension H may be more or less closed by the flap K (situate below the retort), which takes part of the weight of the coal and coke off the conveyor and regulates the delivery of the coke. The flap may by a chain be set at any desired angle, and if wished may be rocked by an eccentric or by a cam preferably arranged on the bottom shaft of the conveyor. The coke is received on an endless travelling band L, with cross-bars M, and is thereby conveyed to be dumped or to be transferred to another conveyor.

The feeding device consists of a drum revolving in a cylindrical casing G, provided with an opening in its periphery so as to be filled with coal from a shoot above, and more or less emptied as it passes the mouth of the shoot F. Any feeding device may be used, so long as it is gas-tight in all positions and delivers into the shoot F in such a manner that the latter is always full and the excess of coal does not jamb the charge but remains in the feeding device.

The retort illustrated is designed so that the maximum heat is applied at the zone where it is most required. For this purpose, the producer gas for heating the retort is introduced into the top flue W from the passage T at ports N, where it meets air issuing through ports O and burns; the products of combustion passing down through the series of flues to escape by the chimney-flue P. The air which issues through the ports O is drawn along channels G between the top of the brickwork and an iron casing R packed with non-conducting material S, and is thus pre-heated.

It will be understood, the patentees point out, that there being a partial vacuum or reduced pressure in the retort, produced by the exhauster, the steam generated by the quenching of the coke as it descends in the water in the sump is drawn up through the hot coke in the retort, and there becomes water gas. If desired, additional steam or steam and air may be admitted into the bottom of the retort through injectors. The water gas may be drawn away with the products distilled from the coal, or there may be provided gas-exits from the retort below the zone of most active distillation, or the mixture of water gas and poor coal gas may be drawn by the chimney draught through these valves into the upper flues, to be there burnt in order to heat the retort, or, again, this mixture of gases may be drawn through the valves by a separate exhauster and used for heating other apparatus or for producing power.

Finally, they say: "Although in the foregoing specification the retort has been said to be single and vertical, it is obvious the setting may be of one or more retorts, and each of these may be set at any angle or angles to the horizon sufficient to ensure the descent of the coal by gravity."

ASSOCIATION OF GAS AND WATER ENGINEERS OF AUSTRIA-HUNGARY.

Annual General Meeting.

The Twenty-Third Annual General Meeting of this Association was held at Cracow from the 5th to the 8th ult., under the presidency of Major F. WALTER, of Vienna. There was an assembly on the evening of Sunday, the 5th, at the Hotel Bristol, at which the Manager of the Cracow Gas-Works (Herr M. Dabrowski) welcomed the members to the city. Those attending the meeting assembled again early the following morning for a visit to the municipal gas-works of Cracow, and the electricity works in course of erection.

The meeting was subsequently formally opened in the Town Hall, when speeches were made by the President on behalf of the Association, and by Dr. Julius Leo, the Vice-Chairman of the City Council. The private business of the meeting was next transacted. The chief items of general interest in this part of the proceedings were (1) the election, as honorary members of the Association, of Herr E. Blum, Manager of the municipal gas-works of Berlin, and Professor H. Bunte, of Carlsruhe; and (2) the choice of Pilsen as the place at which next year's meeting should be held. Then Herr Blum, of Berlin, read a paper on "Novelties in the Gas Industry." The afternoon was devoted to a visit to the water-pumping station at Bielany, where the plant was shown, and explanations given, by Herr Jaszczurowski, the Manager of the water-works. In the evening, the members were the guests of the Corporation at a dinner at the Grand Hotel.

The morning of Tuesday was occupied by technical communications, of the more important of which abstract translations will be given in subsequent numbers of the "JOURNAL." Herr Dabrowski spoke on the advantages of three as compared with two shifts of stokers in gas-works as experienced at Cracow. It was decided to arrange an autumn meeting for a visit to the Witkowitz Iron-Works. In the afternoon, an excursion was made to the salt mines of Wieliczka, which were illuminated for the occasion; and in the evening there was a banquet at the Hotel Bristol.

Wednesday was given up to a tour of the more important of the buildings and interesting sights of Cracow; and this concluded the programme for the meeting, which, according to the official organ of the Association, "Der Gastechniker," was unusually well attended.

THE NEW GAS-WORKS AT DARMSTADT.

By M. Adolphe Bouvier.

[A Paper presented to the Societe Technique Meeting.]

The present paper may be considered as a supplement to the pamphlet issued by the Société Technique last year under the title of "Le Gaz à Dusseldorf." [See "Journal," Vol. LXXXIV., p. 470.] The author, returning from the Dusseldorf Exhibition, had occasion to visit the Darmstadt new works, which were then (June, 1902) nearly finished. He now presents further necessary details, and especially some drawings [three of which are selected for reproduction] which will give an idea of the interesting plant. The site chosen was very restricted, and not very easily to be utilized, but everything has been turned to account. The works are considered a model of their kind in the way of modern plant. At least, all is in keeping and of harmonious design.

The new works (No. 2) were built in 1901-1902 to replace the old (No. 1) works, which made in June, 1902, 8300 cubic metres (293,000 cubic feet) of gas per day, and 20,000 cubic metres (706,000 cubic feet) as a maximum in the winter. The site is generally of triangular shape, and contiguous to the Rhine Railway. The land covers 31,000 square metres (37,077 square yards). A first gasholder, of 9000 cubic metres (317,850 cubic feet) capacity, with iron tank, was put up in the year 1889. The anticipated make is 15 million cubic metres (530 million cubic feet.) After the exhauster, the apparatus is divided into three sets, each for 5 million cubic metres (176 million cubic feet) per year, or for 25,000 cubic metres (883,000 cubic feet) maximum per day. The buildings are constructed with a view to the total production; but only a part of the retort arches and apparatus is erected. In the comparatively restricted area of about 3 hectares (7·4 acres), the new works have four benches of 6 arches of nine inclined retorts, or 216 retorts, 4 metres (13 feet) long, and electrically driven mechanical plant for handling the coal. The coal-stores are placed on the same centre line as the retort-house. They are separated from it, without breaking the continuity, by a narrow building, which covers a coal-conveyor on the Bradley system.

The coal-handling plant (fig. 2) is made up of tilting buckets on a Bradley chain, able to raise 30 tons of coal per hour. The buckets are connected together by five galvanized steel cables. The length is about 120 metres (394 feet), and the chain extends outside the building, under the ground level, so as to cross a pit or hopper into which the coal is thrown straight from the railway trucks, and crushed by a breaker. The chain then stretches out on an incline, next rises along the wall, and returns to the horizontal at the top. There, at certain points, the buckets can be tipped, and the coal automatically thrown either on to two conveyors for the retort-bench, or on to three band-conveyors for filling the stores. A third duty of the chain consists in receiving the coal from the stores, emptying itself at the bottom on to the jigging conveyors, and elevating the coal again to carry it either to the retorts or to another part of the stores. The chain effects, then, three duties: (1) Carrying coal from the yard to the retorts; (2) carrying coal from the yard to the stores; and (3) carrying coal from the stores to the retorts. The fine coal dust which is caused by this manipulation is taken away by a special ventilator.

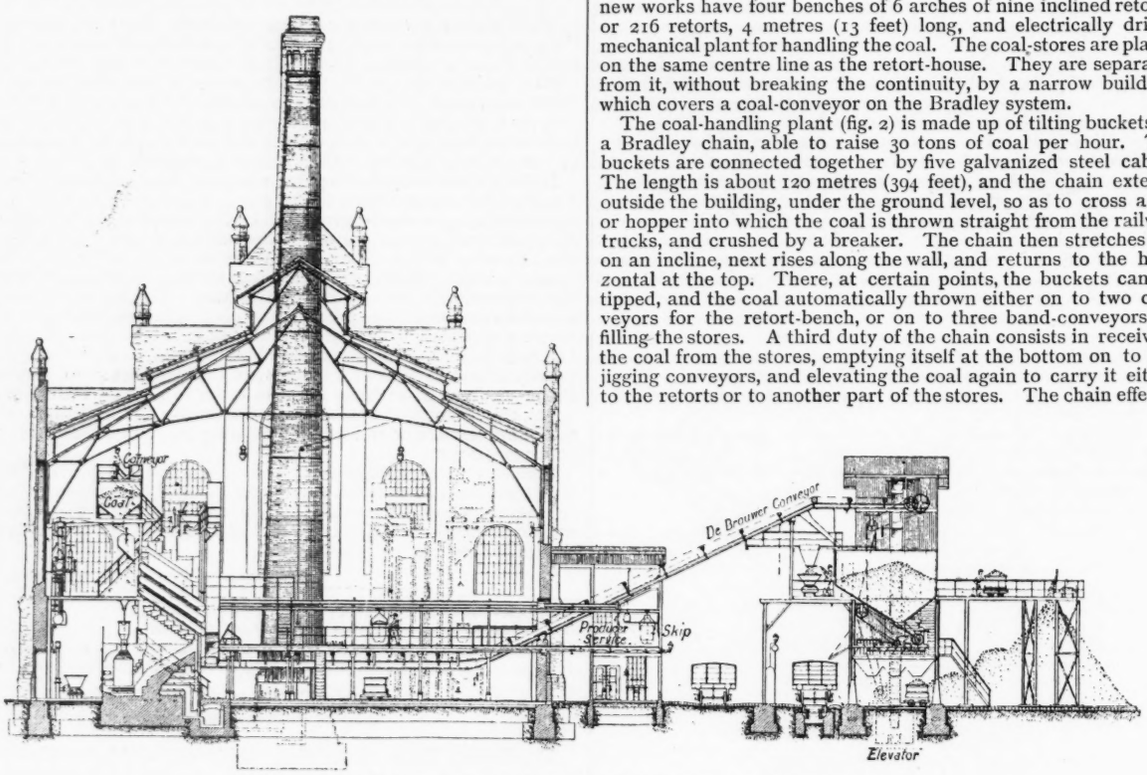


Fig. 1.—Section through the Retort-House and Coke Plant.

The coal-stores (fig. 3) are on the Marshall system—first adopted at Copenhagen, then at Zurich, Geneva, &c. The sides are inclined at an angle of 30°. Three parallel trenches—themselves subdivided into three compartments—form nine stores of 700 tons each, or a total of 6300 tons. Three parallel, quickly-running, band conveyors feed the stores from above, protected by small iron louvre roofs. At the bottom, the stores are automatically emptied by adjustable valves on to three jigging conveyors on the Reiss principle, supported on elastic wooden blades, fed by 36 fixed distributors of the Giroud-Weiss type, which lead the coal back to the main conveyor. All the building is in concrete. Under the sides (inclined at an angle of 30°) are provided empty places on the yard level for stores or depôts for various materials.

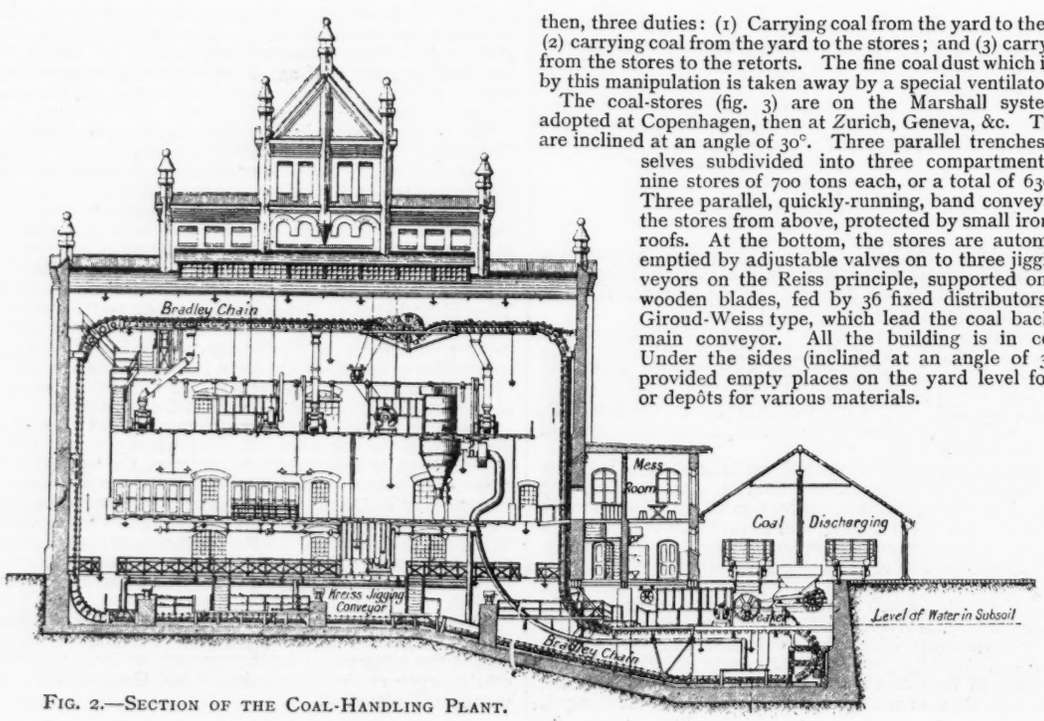


Fig. 2.—Section of the Coal-Handling Plant.

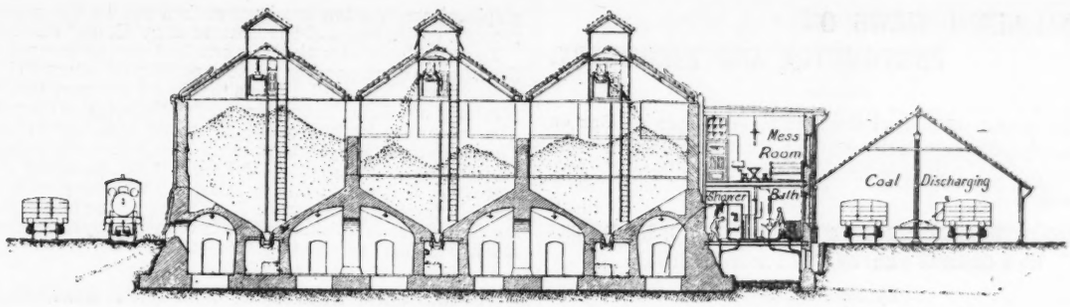


FIG. 3.—SECTION THROUGH THE COAL STORES AND STOKERS' ROOMS.

The retort-house, which is amply ventilated, will contain four benches each of six beds of nine retorts, 4 metres (13 feet) long, and inclined at an angle of 33°. Each bench has a main flue and special chimney, 40 metres high, 1·20 metres in diameter (131 ft. by 47¼ in.). The four chimneys are placed on the centre-line of the house. Each retort is able to carbonize 1250 kilos. (say, 1¼ tons) of coal per day. A bench of six arches can carbonize, at full work, about 67 tons per day, and make 20,000 cubic metres (706,330 cubic feet) of gas, at the rate of 3350 cubic metres (117,720 cubic feet) per arch per day. One man is enough to carbonize 17 tons. There are, therefore, four men at work together for a bench of six arches of nines. Each bed has its special producer, placed on the charging side, and its Drory hydraulic main. The overhead coal-hoppers, filled by two Kratzer conveyors for the four benches, contain the necessary coal for the day of greatest make, and even more—75 tons. The retorts are fed by travelling chargers constructed and working on the Riegel system.

Four parallel hot-coke conveyors—with chimneys for drawing off the steam from quenching—carry the coke to a main De Brouwer conveyor, inclined, and cutting the retort-house into two, and raising the coke up to a steel hopper of 100 cubic metres (3530 cubic feet) in the yard. The coke can thus be discharged by special shoots into tip-waggons running on a Decauville railway, arranged in a closed circle, and at 8·30 metres (27 ft. 3 in.) above the ground. The coke is thus thrown into the yard in a heap; its general form being a cone with a circular base. The conveyor also empties itself into a 5 cubic metre (176 cubic feet) hopper for supplying the skips for feeding the producers. From the 100 cubic metre hopper with inclined sides, the coke falls into a breaker with jiggers, coming out at last into the waggons and carts waiting on a weigh-bridge at the foot of the apparatus, or into measuring sack-fillers. An elevator lifts the coke taken from the yard up to the hopper, and so to the breaker. The breeze is carried to the boilers by tip-waggons, which also run to a coke-store.

The leading gas-main consists at first of two collecting pipes for gas and tar, placed along the two walls of the retort-house. They temporarily join at the outlet of the house into a 500 mm. (20-inch) sheet-iron pipe to cross the yard. For a length of about 130 metres (426 feet) this pipe rests in the open on small columns, 5·50 metres (18 feet) high. It is covered with cork and sail-cloth, so as to avoid a too rapid cooling of the gas.

The condensation is effected by means of two Reutter water-tube condensers, each having 95 square metres (1023 square feet) of cooling surface.

Beale exhausters with three blades for 15,000 cubic metres (529,750 cubic feet) per 24 hours are in operation. From this point, the manufacture is divided into three similar sets. Each of the exhausters, as well as the rotary washers, has its own steam-engine. All the other appliances are worked by electrical motors with continuous current at 200 volts. Each exhauster is provided with a Hahn speed-regulator. There are two automatic bye-passes of the Dessau type.

The physical purification in each set consists of a Pelouze and Audouin condenser, and a Bueb naphthalene and cyanide washer, after which air in the proportion of 1 per cent. is added to the gas by means of a special steam-injector of the Helck model. Then two water-tube Bolz condensers are arranged, each of 100 square metres (1076 square feet) of cooling surface; and, lastly, a Kirkham "Standard" washer, with its steam-engine.

Condensation (or small) tanks, provided on the works, receive the ammoniacal liquor from the condensation, raise it by a small steam-pump, and enrich it by circulation before it is mixed with the liquor from the Kirkham washer. The enriching is done in a Kühler condenser, into which the liquor is thrown by tilting buckets. These tanks also receive the product of the naphthalene washers, and contain a stock of anthracene oil for use in the same washers.

The purifiers are made up, for each set, of three boxes of 7 metres by 8 metres (23 ft. by 26 ft. 3 in.), or 56 square metres (603 square feet), into which the gas enters from the top. There are three-way Baumert valves. The material is carried by skips hanging from an aërial rope-way. The travelling apparatus for the covers also has a length of this rope-way, closed like a buckle, for the return of the skips. The purifier-house is lighted by electricity throughout.

The meter and governor house is also lighted in the same way. The Gareis governors, when complete, will be three in number, of 600, 800, and 400 mm. (24, 32, and 16 inch). The last will be in reserve, in view of supplying a distant district, for which a high-pressure service is anticipated. A special pressure governor is set apart for the working of the telescopic gasholder. In the same room are an alcohol vaporizer, to overcome obstructions caused by the cold, two dial indicators to show the heights of the gasholders, and, lastly, a safety bye-pass for the gasholders, with an automatic alarm signal.

There are two gasholders of 9000 cubic metres (317,850 cubic feet) and 30,000 cubic metres (1,059,500 cubic feet); the latter having three lifts. Both have steel tanks, and are rather more than 41 metres (134 ft. 6 in.) in diameter. No. 2 is heated by a thermo-syphon. At the time of the author's visit, the second gasholder was under construction—compressed air rivetters of two forms being used, one for countersinking and the other for the side sheets.

The principal wells are placed under the ground level of the yard, arched and built in concrete. The general capacity is 1350 cubic metres (47,680 cubic feet). Two of the tanks receive the rain-water. The town's water, at a fairly high price, is used with moderation.

Overhead iron reservoirs for water, ammoniacal liquor, and tar, are arranged throughout the works, and for the filling of waggons with the assistance of two pivoted cranes. The water is used for quenching the coke, feeding the boilers, the automatic flushing of the closets, and the hydrants. The rain-water is reserved for the coke-quenching, and for the cooling of the gas. The pumps are in a half-basement, at the foot of a tower which is a prominent feature of the works.

The machinery room will have four Cornish boilers, each of 100 square metres (1076 square feet), heated with dust and breeze from a blast from a Körting injector. Steam is supplied at 10 atmospheres pressure. A vertical condensing steam-engine of 150-horse power is directly connected to a continuous current dynamo at 200 volts, actuating the different motors in the works, and to effect a part of the lighting by arc (the machinery and the yard) and the incandescent lamps. A second engine in reserve is of 75-horse power. A cooling condenser in wrought iron, of the Worthington type, cools the water from condensation. It is built up in the form of a pyramid in wrought iron, sufficiently high that the natural draught ensures the evaporation of a part of the condensed water, which falls down again in a cascade. The sides of the condenser at the top are open, somewhat in the same way as Venetian blinds.

The electric station is completed by a battery of accumulators of 1053 ampère-hours. The accumulators ensure a supply for the whole night for lighting and for the motors.

The workshops, smiths' shop, &c., are adjacent to the photometer room and laboratory.

The bath-rooms of the stokers, situated on the yard level, will contain, when completed, a total of eight baths, sixteen shower-baths, and a large number of tip wash-basins. The water is heated by steam (Schaffstadt system). Another set of baths and closets is annexed to the machinery room of the electricity station. The two mess-rooms (stokers and yardmen) are placed on the level of the charging stage of the retorts. They are supplied with a percolator, from which coffee is distributed gratuitously to the men. There are also gas-rings, clothes' cupboards, steam dryer, &c. A room for the foreman is situated in front of the retort-house in the middle of the façade.

The railway siding is worked by a steam locomotive without grate—called "à eau chaude"—as in the works at Cassel, Winterthur, &c. There are also two railway weigh-bridges; and, in addition, a Decauville railway for the coke.

All the apparatus—and especially the retort-arches, with their producers—is built in the light and above the ground-level. The shallow subways of the purifiers, condensers, and pumps are sufficiently high to allow of easy circulation. They are finished in white, are light, and are amply ventilated. There is easy access to the different mains. Pressure gauges and thermometers are on the gas-pipes; and the various departments are connected by telephones.

Speaking generally, the new works at Darmstadt—built under the best conditions, without useless extravagance—do credit to the designers.

SOME FRENCH VIEWS ON PHOTOMETRY AND PYROMETRY.

At the recent meeting of the Société Technique du Gaz en France, several papers dealt with the subjects of photometry and pyrometry. The following are abstract translations of these communications.

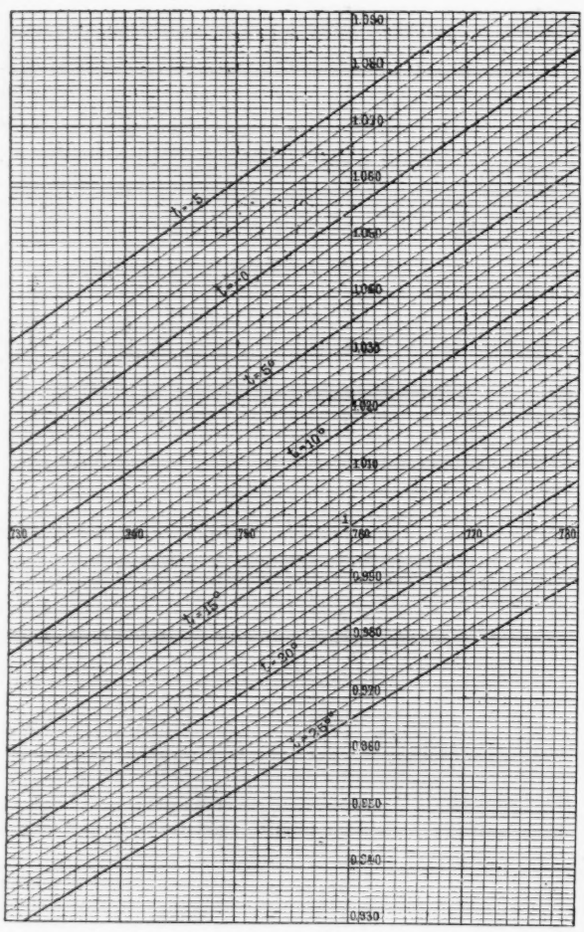
GRAPHIC METHOD OF REDUCING PHOTOMETRIC OBSERVATIONS TO A COMMON TEMPERATURE AND PRESSURE.

By M. PAYET.

Let P be the lighting power of a given gas measured under the pressure H and at the temperature t. We require the lighting value P_o under the pressure H_o and at the temperature t_o. By the laws of Mariotte* and Gay-Lussac—

$$P = P_o \frac{H}{H_o} \times \frac{273 + t_o}{273 + t} \quad (1).$$

In this form the unknown P_o cannot be simply represented by a plane figure, as it is a function of the three variables P, H, and t. In each case it would be necessary to assign values to two of



them in order to deduce the plane relation between P_o and the third; and hence the solution of the problem would be exceedingly complicated. But the difficulty can be evaded by not taking P_o but $\frac{P_o}{P}$ $(= Z)$ as the unknown quantity. This has then to be multiplied by the experimental figure P, to give the result required.

Under these conditions, the unknown quantity Z is represented as a function of H, and, for each value of t, by a straight line of which the general equation is—

$$Z = \left(\frac{273 + t_o}{H_o}\right) \times \frac{H}{273 + t}.$$

It is seen that the angular co-efficients of the lines thus obtained decrease as the temperature rises. The accompanying graphical construction has been worked out for the pressure of 760 mm. (30 inches) and temperature of 15° C. (60° Fahr.).*

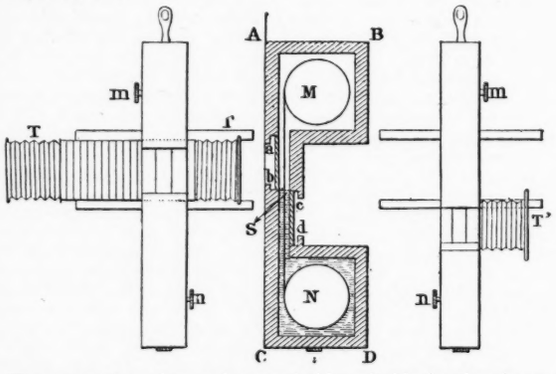
To apply the construction in a practical way, we proceed to find the ordinate corresponding to the experimental value of H. This ordinate we follow until it meets the line of the surrounding temperature; and from this point we read off the height of the ordinate. The value thus found is multiplied by the experimental value P. Thus with the atmospheric pressure at 740 mm. (29 inches), and the temperature at 20° C. (68° Fahr.), it will be found that the correction Z is 0·957; and by this factor we multiply the experimentally found lighting power P. This rapid method of performing the tedious calculations which have frequently to be made will, it is hoped, be of service to photometrists.

* Usually known as Boyle's law in England.—ED. J.G.L.

A PHOTOGRAPHIC METHOD OF MEASURING MULTI-COLOURED LIGHTS.

By M. PAYET.

A method is put forward by the author—frankly as a suggestion unconfirmed in practice—whereby the natural inability of the human eye to compare the intensities of illumination of different colours may be overcome. It is suggested that a photographic record should be made of the total illumination produced by those rays—from the two luminous sources under comparison—which stimulate the retina of the eye, and that from this photographic negative or positive the equality of the illumination from the two sources shall be judged. In making this photographic record, the whole series of radiations proceeding from any light may be allowed to act simultaneously or successively, without affecting the result so long as the light is constant. It is therefore suggested that during the exposure of the sensitive film, a glass or series of glasses composed of the spectrum colours in their natural order, shall be moved in front of the film at a uniform speed, which shall be as low as possible. This is done with the object of recording, for each of the two lights, the total of the partial effects produced in succession and in equal times by the whole of the radiations from the two lights under comparison. If the photographic deposits thus obtained are equal in intensity (density), the visual intensities of the two lights may be considered equal.†



The apparatus advanced as probably suitable for the observations suggested above is represented in the figure, and would not be difficult to construct. It consists of a box A B C D, on which the sensitive film S is rolled from one drum M on to another N; these drums being rotated by the winding-keys m and n. There is a window at a b, through which exposure is made, and which is covered or uncovered by the shutter T. The film would pass from this exposure chamber to a developing bath placed in the apparatus; the intensity of the developed image being finally observed through the window c d, after withdrawing a shutter T^1. Lastly, in the same grooves as the shutter moves the glass or series of glasses of spectrum colours, arranged longitudinally from violet to red. This glass forms part of the shutter T; an opaque portion of the latter covering the plate after exposure.

The apparatus would be used somewhat as follows: The two lights having been placed so as to give equal illumination on the

* On the mathematical bases that $\frac{P_o}{P} = Z$, that $273 + t = T$ (the absolute temperature), and that $\frac{288}{H_o} = K$ (constant), the equation (1) above becomes

$$Z = K. \frac{H}{T}.$$

This is one form of the Clausius theory of the three dimensions of gases; and it will be seen that the equation connecting, in this system of co-ordinates, the variations of the unit volume (*i.e.*, the corrections Z), the absolute temperatures, and the barometric pressures, is that of an equilateral hyperbolic paraboloid, the asymptotal planes of which are the planes of the co-ordinates $Z = o$ and $T = o$. The straight lines in the graphic construction are the projections on the plane Z H of the intersections of this surface by the planes T = 273, T = 278, T = 283, and so on.

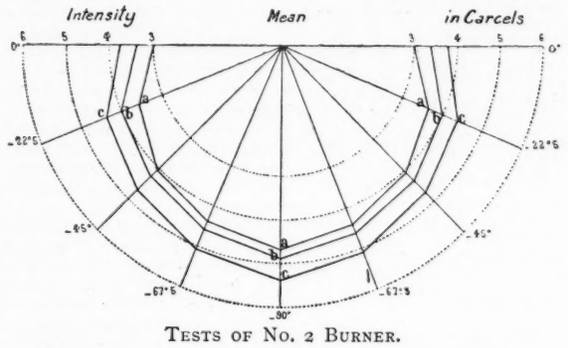
† The assumption implies the adjustment of the photographic plate to match a normal vision in colour sensitiveness. M. Payet appears to think that there are commercial "orthochromatic" plates suitable for the purpose that he has in view. But it is more than likely that a light filter would be required in order to control the plate; thus further complicating the method.—ED. J.G.L.

screen of (say) the Dumas and Regnault photometer, the sensitive surface is brought into the position of the screen, and the shutter T opened. The glass is then moved with a very slow and uniform movement across the opening *a b*, which is finally closed by the hinder part of the shutter. From the pair of densities thus obtained on the film, the equality or otherwise of the illuminations is judged; and further trials are made (with the lights differently placed) if the first does not show the densities equal.

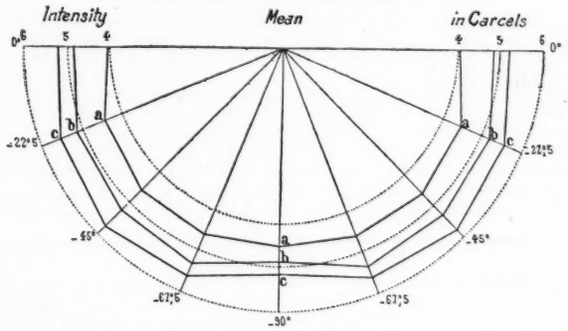
PHOTOMETRIC TESTS OF AN INVERTED BURNER.

By M. Th. Vautier.

The following tests were carried out on Liais burners, the rays being transmitted horizontally to the photometer by means of mirrors of previously measured absorption. Some preliminary tests on a No. 2 burner showed that at low pressures the light is unsteady. It was found to give the best results between 35 and 55 mm. (14 and 22 inches). The three pressures 38, 45, and 55 mm. were adopted for the tests; the burner being adjusted at its best



Tests of No. 2 Burner.



Tests of No. 3 Burner.

for a pressure of 45 mm. The intensity was measured in the horizontal direction and at the following angles below the horizon: 22·5°, 45°, 67·5°, and 90°. For the tests with both No. 2 and No. 3 burners, four different mantles, selected haphazard, were successively used. The following tables give the tests with these mantles, and also the mean of the four sets of observations. On the diagrams, the curves *a a*, *b b*, and *c c* show the mean intensities of the four mantles at the pressures 38, 45, and 55 mm.

Liais Burner No. 2.

Constants of the Gas.	Angle of Illumination to Horizon. Degrees.	Light Intensity in Carcels. Pressure, 38 mm. Hourly Consumption, 48 Litres.	Pressure, 45 mm. Hourly Consumption, 56 Litres.	Pressure, 55 mm. Hourly Consumption, 62 Litres.
Mantle No. 1.				
Lighting power, 123·5 litres per carcel-hour. Density, 0·413.	0·0	3·15	3·40	3·80
	22·5	3·80	4·20	4·30
	45·0	4·40	4·50	4·55
	67·5	4·40	4·55	4·85
	90·0	4·75	4·95	5·40
Mantle No. 2.				
Lighting power and density as above.	0·0	2·10	2·95	3·60
	22·5	3·25	3·60	4·00
	45·0	3·50	4·00	4·50
	67·5	3·80	4·20	5·35
	90 0	4·20	4·75	5·70
Mantle No. 3.				
Lighting power and density as above.	0·0	3·10	3·70	4·20
	22·5	3·80	4 30	4·85
	45·0	4·40	4·65	5·25
	67·5	5·05	5·15	5·45
	90·0	5·35	5·45	5·70
Mantle No. 4.				
Lighting power 120 litres per carcel-hour. Density, 0·413. Calorific power (water as steam), 4420 calories.	0·0	3·15	3·55	3·70
	22·5	3·45	3·80	4·30
	45·0	3·80	3·90	4·40
	67·5	4·10	4·30	4·75
	90·0	4·40	4·55	5·15

Mean of Preceding Four Results.

Lighting power, 122·6 litres per carcel-hour. Density, 0·413.	0·0	2·90	3·40	3·85
	22·5	3·60	4·00	4·35
	45·0	4·05	4·25	4·70
	67·5	4·35	4·55	5·10
	90·0	4·70	4·95	5·50
Mean spherical intensity		3·7397	4·0697	4·5029
Consumption per spherical carcel-hour .		12·8 litres	13·7 litres	13·7 litres

Liais Burner No. 3.

[Mean of tests with four different mantles.]

Lighting power, 130·2 litres per carcel-hour. Density, 0·406.	0·0	4·05	4·85	5·20
	22·5	4·45	5·15	5·55
	45·0	4·60	5·35	5·80
	67·5	4·60	5·35	5·65
	90·0	4·50	4·90	5·15
Mean spherical intensity		4·4378	5·1662	5·5497
Consumption per spherical carcel-hour .		16·1 litres	15·6 litres	15·8 litres

In the case of the No. 3 burner, the pressures at which the gas was burnt were the same as for the No. 2, but the respective hourly consumptions were 71·5, 81, and 88 litres. The variations between the four mantles are rather less than in the case of the No. 2 burner, and therefore only the mean of the set is given.

THE FERY PYROMETER.

By M. Foiret.

Unlike other pyrometers, such as those dependent on expansion of a metal or the variation of an electric resistance—which instruments are not comparable among themselves and also become useless from molecular changes—the Féry pyrometer measures temperature by radiation, but is nevertheless so constructed as not to require the delicate handling of a trained operator. It can be placed in workmen's hands.

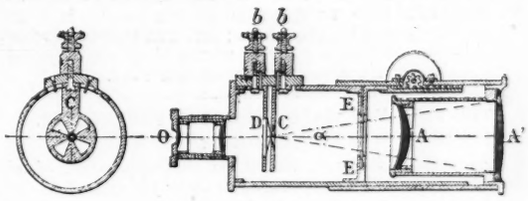


Fig. 1.

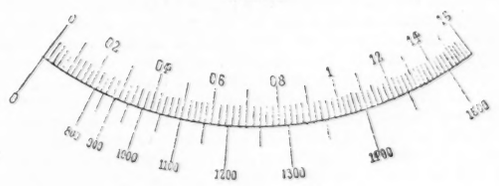


Fig. 2.

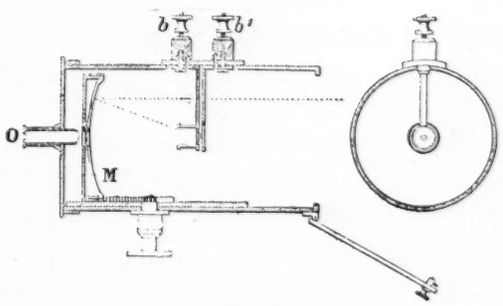


Fig. 3.

The apparatus consists of a lens, and a galvanometer connected thereto by two conducting threads. At the focus of the lens is a thermostatic couple, formed by the junction, in the form of a cross, of two threads of different metals, iron and "constantan." These two threads are fixed by their extremities to two brass plates C and D, which can be introduced into an electric circuit by the terminals *b b* (fig. 1). A screen, likewise in the form of a cross, but with its centre pierced, leaves exposed only the couple of the thermopile. The junction of the threads is the sensitive portion of the apparatus.

In measuring the temperature of a furnace with one of these pyrometers, the furnace is sighted at O with the lens, and the image obtained at the centre of the cross. This image is not only luminous but calorific. The heat rays are transmitted by the two lenses A and A¹, with the object of further concentrating the heat. The rays thus brought to a focus increase the temperature of the junction and a current is produced which is

measured by the deviation imparted by it to the galvanometer needle. The diaphragm E, fixed at a short distance from the focus, cuts down the cone of heat rays impinging on the thermo-pile to a constant angle, so that the readings of the apparatus do not vary with each position of the lens.

In fig. 2 is shown the galvanometer scale half size. It will be seen that the angular divisions are unequal, and that the sensitiveness of the apparatus is greater as the temperature is higher. This follows from Stefan's law of radiation—viz., "the quantity of heat radiated by a dark body, or by the mouth of a furnace, is proportional to the fourth power of the absolute temperature of this body or of the furnace." The stipulation "dark" body implies a substance emitting in normal proportion all the radiations which give to it its temperature. Carbon and black metallic oxides are examples of such substances. A furnace with a very narrow orifice for the emission of radiations likewise corresponds with this theoretical definition. On the other hand, it is shown by experiment that the percentage of absorption by a fluorspar lens becomes constant for heat rays above 900° C.; that is to say, the ratio of heat absorbed to heat transmitted is constant above this temperature. Hence a lens standardized above 900° permits of unknown temperatures which correspond to an observed radiation.

To take an example. Suppose the reading of the galvanometer is 75 mm. when the apparatus is directed to a furnace at 1000° C., and 300 mm. when the lens is pointed to a body at an unknown temperature x, by Stefan's law—

$$\frac{x^4}{(1000 + 273)^4} = \frac{300}{75}$$

Or $x = 2547$ absolute temperature $= 2274°$ C. It is seen that a fairly large error in the radiation produces a smaller percentage error in the temperature, as this latter is given by the fourth root of the galvanometer reading.

The apparatus works between 900° and 1700° C.; but the lens is provided with several diaphragms, by means of which a single instrument can be made to record temperatures from 900° to 4000° C. In certain industries, it is necessary to measure temperatures below 900° C.; so M. Féry has prepared a new model of the pyrometer with a range from 500° to 1000°. It is shown in fig. 3. The principle is the same; but greater sensitiveness is obtained by substituting a concave mirror M for the object-glass of the lens used in the apparatus above described.

THE SIMMANCE-ABADY "FLICKER" PHOTOMETER.

By M. Foiret.

A note was read by M. Foiret on this apparatus, of which several descriptions have appeared in the "Journal." M. Foiret pointed out that, in practical work with the photometer, a slight difference in colour between the lights under comparison in no way prejudices the accuracy of the results. Such differences disappear the moment the two conical surfaces are obtained equally illuminated. The observer sees only one uniform tint intermediate between those of the two illuminants. For this reason the instrument is well adapted to the photometry of incandescent burners and arc lamps when these are being measured against the carcel lamp or electric lamps. One advantage of the photometer lies in the accuracy and rapidity with which observations can be made by persons not possessing previous photometrical experience.

PAPERS ON GAS-METERS AT THE SOCIÉTÉ TECHNIQUE MEETING.

As briefly mentioned in the course of the general notice of the recent meeting of the above-named Society which appeared in the "Journal" for the 21st ult. (p. 846), some of the papers dealt with the subject of meter construction. The following abstract translations will indicate their scope.

M. Lacaze described the "Constant" dry meter. He began by reminding the members that at the congress held in 1900, M. Bigeard discussed the question of the relative advantages of wet and dry meters. In the course of his remarks, he stated that on testing his wet meters in 1898, he found that not one of them registered against the consumer; and he thought this would not have been the case with dry meters. He considered that these meters should be officially tested and stamped; whereupon M. Rouget remarked that they would never be stamped if the existing conditions remained in force. The author was also of this opinion; and he quoted the argument brought forward in 1871 against the official stamping of dry meters in Paris, on the ground that their registration was variable—being sometimes above and sometimes below the quantity actually measured. M. Lacaze inquired into the causes of these variations, with the object of finding a remedy for them. Having explained the mechanism by which the gas is measured in dry meters—viz., by means of a bellows—he said that so long as the working conditions were normal, the meters would register accurately; but in the event of the membrane being put out of shape by extra pressure or a jolt in carriage, it would not work properly. In order to prevent the convex part of the membrane losing its shape, it occurred to the Compagnie Continentale pour la Fabrication des Compteurs à Gaz to make the bellows of such a form that the greatest pressure is always exerted on the concave part of the membrane, which will always have a tendency to inflate. The entering fold mentioned previously can be avoided in this way. A meter of the new type, tested every fortnight during a year, did not show any variations of measurement in any of the successive trials. At the time the modification in the form of the bellows was made, the Company introduced an improvement in the mounting of the bellows on the meter. They are simply attached with screws, so that repairs are very easy when needed. Moreover, the bellows not being mounted on a part which has subsequently to be soldered to the meter, there is no fear of the hot soldering-iron injuring the membrane. The makers of the meter therefore consider that it will be as reliable as a wet meter for permanent accuracy of registration.

Another meter brought under the notice of the members was the "Simplex," on which a short paper was submitted by M. Rouget. He explained that it had been put upon the market by an important firm, and that one of its chief characteristics was that the drum could make 200 revolutions against 100 of the ordinary meter, with no additional pressure, which was only 1-10th for a 5-light size. The meter works with a constant water level, which is effected by an ingenious arrangement, consisting of a modification of the angle of inclination of the blades, whereby the admission of water into the drum is regulated. The makers claim that their drum can be easily adapted to an ordinary meter without interfering with the case; and consequently the capacity of a station meter could be doubled without difficulty.

In another paper, the same author dealt with the effects of chemical action resulting from imperfectly purified gas upon the mechanism actuating the working parts of wet meters. Ammonia is the chief cause of the trouble; attacking the metals exposed to contact with it, and generating electro-chemical couples. In order to obviate this, the author conceived the idea of having an ebonite wheel and a bronze screw; and he tried the effect on two meters placed side by side—one fitted with the new device, and the other with the same parts made in bronze; both being frequently "watered" with ammoniacal liquor. The experiments extended over a period of 15 months, during which time 5000 cubic metres, or about 176,000 cubic feet, of gas passed through the meters. The result was that the bronze parts were very much eaten away, which, of course, would interfere with their exact action, whereas the ebonite wheel and the bronze screw were unaffected. The author claimed that by this simple device he had succeeded in prolonging the life of a meter working under conditions which would render it unfit for use after two years' work.

Society of Engineers.—A highly interesting visit was made by the President (Mr. D. B. Butler) and members of the Society, on the 29th ult., to the Portland cement-works of Messrs. Martin, Earle, and Co., Limited, at Wickham, Rochester, where they witnessed the manufacture and testing of cement made by the ordinary method and by the new rotary kiln system. The works, which are about a mile in length, were acquired by the present Company in 1891, when the plant consisted of only a few kilns of the chamber type, and a pair of mills for grinding the clinker; power being supplied by a 250-horse power beam-engine. The works were enlarged from time to time, until in 1899 they were equal to an output of 3000 tons per week, and are now considered to be the largest cement-works in Europe. Upon their arrival, the visitors were received and cordially welcomed by Mr. Vavasour Earle and other members and officials of the Company, by whom they were conducted over the works—following in consecutive order the various stages of the manufacture of cement.

Birthday Honours.—Among the distinctions bestowed by His Majesty this year in honour of his birthday, we were pleased to notice that several have been conferred on gentlemen more or less closely connected with the two interests with which the "Journal" is identified. Sir Robert Ropner, M.P., who is one of the seven new Baronets, is a Director of the Hartlepool Gas and Water Company. Mr. Walter R. Plummer, M.P., who is one of the new Knights, is upon the Board of the Newcastle and Gateshead Gas Company; while another, Mr. Lloyd Wise, who was the first President of the Chartered Institute of Patent Agents, is a Director of the Southend Gas Company. Mr. Benjamin Scott, who also receives a Knighthood, has been four times Mayor of Carlisle, and has closely associated himself with the gas and water undertakings of the city. The same group contains the name of Dr. T. Stevenson, the Scientific Analyst to the Home Office; and also that of Professor Dewar, who has for some years been associated with Sir William Crookes in examining the water supplied to the Metropolis. It may not be out of place to record here that last Wednesday this distinguished Cambridge Professor received the degree of Doctor of Science at Oxford. Among the new Companions of the Bath (Civil Division) is Mr. J. Lithiby, one of the Assistant Secretaries of the Local Government Board. He prepared the Bill which formed the basis of the Metropolis Water Act, 1902, by which the undertakings of the Water Companies were transferred to the Metropolitan Water Board, and gave evidence in support of it before the Joint Parliamentary Committee to whom it was referred.

INTRODUCTION OF WATER GAS INTO RETORTS IN WHICH COAL IS UNDERGOING CARBONIZATION.

(*Continued from Vol.* LXXXVI., *p.* 957.)

The results obtained in the trials are shown in Tables II. and III. The yield of coke was practically the same when self-carburetting was being carried out as when neat coal gas was produced. The quality of the coke also appeared to be the same. In the make of gas, however, there are marked differences. When neat coal gas was being made, from 9983 to 10,620 cubic feet of it was obtained per ton of coal; but when self-carburetting was practised, the yield of coal gas per ton of coal carbonized was only from 9688 to 10,155 feet. The proportion of water gas averaged 28 per cent. of the mixture. The low yield of 9983 cubic feet per ton of coal in the first set of trials was due to the low make on the first three days (= 28 hours) after starting the setting. If these three days' working is discarded, the average yield of neat coal gas throughout the remaining days of all three sets of trials was 10,550 cubic feet, and that of coal gas in the two sets in which self-carburetting was practised was only 9904 feet per ton of coal carbonized. That is to say, the yield of coal gas was reduced by nearly 6½ per cent. in consequence of the adoption of the self-carburetting arrangement.

The number of British thermal units obtained in the coal gas per ton of coal carbonized (calculated from the net calorific power of the gas) averaged 6,461,280 for trials 1, 3, and 5 (when the first three days' working was discarded for the reason already given), and 6,032,980 for trials 2 and 4. This signifies a loss of nearly 7 per cent. as the result of the employment of self-carburetting. The fall in lighting value is, however, even more marked. With the neat coal gas, the candles per ton of coal averaged 37,315; but with self-carburetting only 27,525 candles per ton of coal carbonized were obtained. So there was a loss under this head, due to self-carburetting, of 26 per cent. The calorific power per cubic foot of coal gas was practically the same in sets of trials Nos. 1, 2, and 3; but comparison of this factor for sets Nos. 4 and 5 shows a small diminution in the case of self-carburetting.

Comparison of the illuminating and calorific powers, as determined in the course of working, shows that the fluctuations are very much greater when self-carburetting is in operation than when neat coal gas is produced. Thus between 3 and 5 o'clock on April 6, nine testings of the calorific power of the coal gas were made; and the results for the gross value were: Mean 662, maximum 673, and minimum 628 B.T.U. per cubic foot at the prevailing temperature (17° C.), and the pressure (705 mm.). On the other hand, 17 calorimeter readings on March 30 between 3.15 and 7.15 p.m., when self-carburetting was proceeding, showed a mean gross value of 526, with a maximum of 588, and a minimum of 489 B.T.U. per cubic foot at the prevailing temperature (17° C.) and pressure (690·5 mm.). Similarly 16 testings made of the illuminating power of the coal gas, ranging over 3¾ hours on the afternoon of April 6, showed corrected results having a mean of 18·5 English candles, with a maximum of 19·4, and a minimum of 17·3. But 18 testings of the illuminating power of the self-carburetted gas on March 30, ranging over a period of 4 hours 10 minutes, gave a mean of 9, with a maximum of 12·9 and a minimum of 4·5 candles (corrected). The gas for these testings was drawn from between the meter and the gasholder; so that it had already undergone a good deal of mixing. Such fluctuations as these must in times of heavy consumption, when self-carburetting would be most helpful, be very troublesome—to say the least—to consumers, even if benzol is added to the gas. Herr Croissant has attempted to get over this want of homogeneity of the self-carburetted gas by charging the setting of nine retorts thrice instead of twice, thus making the working more complex; but even with this method he does not appear to have attained his object.

In regard to the quality of the tar, the authors' experiences differed from those of the earlier observers. For instance, Professor Vivian B. Lewes could detect no alteration in the tar when self-carburetting was adopted, though Herr Croissant found it to be thinner. The authors found no marked change in the tar in their first set of self-carburetting trials. In the second set, however, it became so thick that the hydraulic main and tar-pipes had to be steamed out; while the tar itself, instead of being of a shining black colour, was greyish black and dull, and had lost the fresh smell of coal tar. All these experiences led the authors to the conclusion that nothing was to be gained by continuing the trials, more especially as a re-calculation of results from the figures given by so ardent an advocate of the process as Professor Lewes

TABLE II.—*Neat Coal Gas Trials, Sets 1, 3, and 5.*

Series of Trial.	Dates. 1904.	Net Duration in Hours.	Coal Carbonized. Tons.	Coke made. Percentage of Weight of Coal.	Gas made per Ton of Coal. Cubic Feet.	Calorific Power of Gas. B.T.U.'s per Cubic Foot.*		B T.U. (net) in the Gas, per Ton of Coal.	Illuminating Power.† English Standard Candles.	Candles per Ton of Coal.
						Gross.	Net.			
1	March 15 to 19	46	13·132	68·3	9,983	670	600	5,993,286	—	—
3	March 25 to 26	20	5·812	68·0	10,388	662	595	6,180,733	—	—
5	April 5 to 7	32	8·869	72·2	10,620	687 (699)	622 (629)	6,599,578 (6,683,443)	17·93 (17·20)	38,090 (36,545)

TABLE III.

Self-Carburetted Gas Trials, Sets 2 and 4.

Series of Trial.	Dates. 1904.	Net Duration in Hours.	Coal Carbonized. Tons.	Coke made. Percentage of Weight of Coal.	Cubic Feet of Coal Gas made per Ton of Coal.	Composition of Mixed Gas. Volumes per cent.		Calorific Power. B.T.U.'s per Cubic Foot.*					B.T.U. (net) in the Gas, per Ton of Coal	Illuminating Power.† English Standard Candles.	Candles per Ton of Coal.
								Mixed Gas.		Water Gas.		Coal Gas.			
						Coal Gas.	Water Gas.	Gross.	Net.	Gross.	Net.	Net.			
2	March 21 to 24	32	9·459	67·7	10,155	71·8	28·2	565 (562)	508 (506)	293	270	598 (599)	6,067,555 (6,094,770)	— —	— —
4	March 28 to 31	42	11·934	72·5	9,688	72·2	27·8	581 (581)	522 (522)	305	281	617 (615)	6,003,648 (5,965,948)	10·23 (10·27)	27,473 (27,580)

* Under standard conditions of temperature and barometric pressure (60° Fahr. and 30 in.).
† Actual rate of consumption, approximately 150 litres at 702 mm. and 15° C. =4·89 cubic feet per hour at 30 inches, and 60° Fahr. The figures given are for a rate of 5 cubic feet (at 30 inches and 60° Fahr.) per hour, having been calculated by proportion from the actual rate.
Note.—The figures in brackets refer to samples of gas drawn from the gasholder; all others refer to samples from the working main.

TABLE IV.

Data given by Professor Lewes.

Percentage of water gas added	0	21·9	25·5	27·8	37·6	40·1	42·0	45·6
Total make of gas per ton of coal (cubic feet) .	9,907	12,671	13,023	14,024	13,404	14,715	14,92	14,726

Deductions by the Authors.

Coal gas made per ton of coal (cubic feet) . .	9,907	9,896	9,703	9,766	8,364	8,815	8,657	8,011
Percentage loss of make of coal gas	—	0·1	2·0	1·4	15·5	11·0	12·6	19·1

supported the authors in their conclusion. His figures are given in Table IV., together with their calculations therefrom.

It is to be regretted that none of those who have tried the revived self-carburetting process have given adequate particulars. Such would have enabled the authors to know whether they were actually working according to Lewes's patent, or whether they had fallen into the excusable blunder of working merely according to the older, and indeed obsolete, process patented by Aitken and Young. Professor Lewes has made the following statement: "I must, however, in taking leave of the subject, warn you that it is probable that much may depend on the quality of the coal; and that whereas with rich coals, shales, and cannels, the gain may run up from 30 to over 100 per cent., yet that with poor coals the results may be inferior to those I have brought before you. I, however, feel convinced that, as your investigations proceed, the possibilities of enriching water gas with illuminating hydrocarbons that are at present lost in the formation of tar will exceed expectations (see "JOURNAL," Vol. LXXVIII., p. 626).

It might be asked when and where a gain of 30 to over 100 per cent. has been obtained. At the beginning of their trials, the authors also expected that a part of the hydrocarbons which form tar would contribute towards raising the value of the gas. They used richer coals than Professor Lewes had used, and yet obtained very unsatisfactory results. He had in mind the proved advantage afforded by the carburetted water-gas process in the conversion of oil into permanent lighting and heating gas. But thorough consideration of the facts will disclose a difference between the pyrogenic decomposition of gas oils in the presence and in the absence of water gas, and the gasification of coal with and without passing water gas over it. Thus the gas made from oil in oil-gas retorts has a specific gravity of 0·62 to 0·70, and a lower calorific power, though the yield is greater than that of the oil-gas portion of carburetted water gas from the oil; while the specific gravity of this portion ranges from 0·9 to 1·6. The heating value of the gas made in oil-gas retorts represents 50 to 60 per cent. of the heating value of the oil, whereas the oil-gas portion of carburetted water gas corresponds with 55 to 90 per cent. The advantage of the carburetted water-gas process over the admixture of oil gas and water gas in the cold is obvious from these figures, which do not express the convenience of manufacture per unit volume in the carburettor as compared with the retort.

The advocates of self-carburetting appear in the main to have in mind that there must ensue a flushing out of the vapourized hydrocarbons, from which there result—by combination of two or more molecules, with splitting off of hydrogen—secondary high-molecular solid hydrocarbons, such as naphthalene, acenaphthene, fluorene, and anthracene. Experience teaches that the formation of naphthalene increases as the temperature of the retorts rises. Consequently, it would seem best to flush out with water gas towards the end of the period of carbonization, when the temperature is highest. Herr Merz, the late Manager of the Cassel Gas-Works, described the charging of the retorts as having the effect of a wet blanket. The initial temperature must be still further depressed by the immediate inflow of water gas; and a still greater divergence must thus be created between the initial and the final temperatures of carbonization. Herr Croissant has testified that the formation of scurf in the retorts is not avoided or even minimized by self-carburetting. The fact that naphthalene stoppages at Ludwigshafen were got rid of is not to be ascribed to self-carburetting itself, but rather to the greater amount of benzol added to the self-carburetted gas. The hydrocarbons which are solid at ordinary temperatures, resulting from the primary stage of the carbonization of coal, would, however, by the flushing out with water gas, be removed without being subjected ultimately to a splitting up through the radiant heat from the retort walls.

Disregarding theoretical speculations on the self-carburetting process, the ascertained facts in regard to it are, that the passage of cold water gas over coal undergoing carbonization not only produces no gain, but causes considerable losses in comparison with the admixture of cold water gas with cold coal gas. Thus the result attained is the reverse of that of the carburetting of water gas, which is so extraordinarily favourable.

Carbide of Calcium and its Commercial Development.—The "Scientific American" is responsible for the following: The important effect which Willson's discovery of electrically producing calcium carbide in commercial quantities will have upon the gas industry of the civilized world (an effect which is due in part at least to the very simplicity of producing the gas) may well be shown by tracing the development of the carbide and acetylene industries in Germany. There are about 8000 acetylene installations, of all capacities, in active operation at the present time in that country. Acetylene is coming into use for driving gas-engines; 5·65 cubic feet develop 1-horse power, for the development of which 21·19 cubic feet of coal gas are required. The small weight of carbide needed for the production of a given illumination gives acetylene an advantage over other illuminants for Colonial and military uses, where the cost of transport forms an important item. The high temperature of 2700° of the acetylene bunsen flame renders it valuable for soldering purposes. For miners' and other portable lamps, a portable acetylene generator is now largely used. Acetylene is also adopted in factories and other places where colours have to be distinguished and compared by artificial light.

CONCRETE AND PUDDLE FOR RESERVOIR EMBANKMENTS.

The discussion on the paper on the above subject read by Mr. W. Watts at the annual meeting of the British Association of Water-Works Engineers, and given in the "JOURNAL" last week (p. 957), brought out several interesting points which are noticed below.

The first speaker was Mr. Earle, the extensive cement works of whose firm the members were afforded an opportunity of visiting on the morning of the second day of the meeting. There they heard an account of the percolation tests carried out by means of the improved apparatus invented by Mr. H. W. Anderson, of Teddington, who is associated with the firm and is a member of the Standardization Committee on Cement. Referring to the paper, Mr. Earle remarked that the author did not appear to attach any value to office tests of cement. His own feeling was, after having spent some three or four hours every day for several years of his life in making various sorts of tests, that life was hardly worth living without them. In this way, he had found out many little tricks. He thought if every engineer took the boiling test and made that alone, and cement passed a heat of 212°, he need not trouble his head about anything else. Mr. Earle concluded by advocating a standard for cement, both for quality and dryness.

Mr. Earle's remarks very suitably prefaced those made by Mr. Anderson, who followed him. He explained how the percolation machine above alluded to was first introduced for water-works purposes. Some years ago, he was consulted in Spain as to the best material for making some large underground storage reservoirs water-tight. The Commissioners responsible for the scheme were utilizing sand from the sea-shore some distance away, and sterilizing it before use, so as to purify it from any decayed matter. With this they were plastering the face of the blasted limestone, and rendering to a finished trowelled surface; the water pressure on this at the bottom being, when the reservoir chambers were full, equal to a 22 feet head. The small discs tested under the available percolation machines hitherto in use all over the Continent were too small to give any comparative idea, and this machine was devised to meet on a larger scale the testing of samples up to a square foot in area and up to 12 inches in depth. The result of the investigation of the samples made from the limestone powder and the more costly sterilized sea sand was distinctly in favour of the former, and saved a good deal of money by adopting it for use in the work. Touching upon the delusive method of measuring cement referred to by Mr. Watts, and the varying weights per cubic foot, he recommended shallow measures for cement, as the deeper they were the larger the variation that arose in each. This, he said, was easily demonstrated by the bushel measure. Referring to the air cracks alluded to by Mr. Watts, they were most probably not due to overliming, but to too great a richness of the mixture on the surface where they occurred. Regarding the cost of lime concrete compared with cement concrete, this seemed to be based by Mr. Watts on the assumption that all lime weighed the same per cubic foot. He himself had found in some limes as much as 80 per cent. or more difference in the weight per cubic yard; and this fact would throw over the comparative costs stated by Mr. Watts. He did not agree with Mr. Watts in ignoring tests carried out on the work. It was only by means of them that one knew that the qualities of the article specified were upheld, though with firms of absolute integrity and high repute, an engineer could often safely rely upon their promises being carried out, especially if the cement arrived on the job in sealed bags.

At this point the discussion was adjourned till the next day, when it was resumed by Mr. A. E. White, the Borough Engineer of Hull. He mentioned a case in which he had to carry out a sewage-pumping station in Hull, and said the pumps in connection with it were placed a considerable depth below the surface of the ground in what was practically a concrete tank or chamber. The depth of this chamber below the ground to the floor was about 25 feet, and it was 6 feet in length and 25 feet in breadth. The excavation for it went through some very bad ground, and the sides had to be most carefully timbered. The foundation was good—getting on to the boulder clay. The concrete used for the bottom and walls of the chamber was 4 to 1. The bottom was 4 feet in thickness. The sides were 3 ft. 6 in. thick for rather more than half the height to the ground level; then they were reduced somewhat to the point where they received the walls of the engine-house. For lateral support, the walls inside were strengthened by cast-iron girders and struts across the chamber. The result of this construction, as regarded water-tightness, was that on completion there were a few very small leaks through the concrete; but in course of time these all practically closed up, and the chamber was now as nearly as possible sound. He thought there was no doubt that, to obtain the best results as regarded water-tightness in concrete, it was very desirable that the concrete should not be mixed with more water than was necessary, and that in filling the concrete should be well trodden down and rammed until the water appeared on the surface of each layer. No doubt the ideal quantity of water to use was just sufficient to enable the water to come to the surface when it was rammed.

Mr. C. Clemesha Smith complimented Mr. Watts on his very practical paper. At the same time, he ventured to differ from him on one point. He preferred puddle to concrete, where it could be procured of a strong, tenacious nature. It was more elastic, and more easily inspected. With regard to the use of concrete walls in the trench, he had employed both concrete and brickwork, and had not yet found that the concrete had been rushed into the puddle. He had known the puddle, where the pressure had been heavy, to stand better than the timbering; but no hard-and-fast line could be drawn. They must be guided by the circumstances in each case. If good puddle could not be obtained, they should by all means use concrete. With regard to springs in the bottom of the trench, this was one of the most important matters they had to deal with. It was, of course, well to get below the springs; but if the circumstances were against them, he thought the best thing was to leave a space in the concrete or puddle to form a shoe for the water to come up. It was as well to carry 4-inch steel tubes with the outlets every 3 feet apart. These pipes were not only carried to the top of the trench, but of the embankment, and were afterwards used for the purpose of inspection by taking the water-level, so that it could be seen what was happening in the strata as the reservoir was filled. One could not draw a hard-and-fast line as to construction for reservoirs. Each case must be dealt with separately.

A valuable contribution to the discussion was made by Mr. R. E. Middleton, Joint Engineer (with Mr. Walter Hunter) of the Staines reservoirs scheme. The point he particularly wished to dwell upon was the use of puddle or concrete in the trench of a dam. He acknowledged that Mr. Watts had made out a very good case for his concrete, on the basis of the fact that a considerably greater quantity of puddle was to be used than of concrete in the trench. He, however, did not really see why these enormous thicknesses of puddle should be put in reservoir trenches; the puddle being merely a medium to stop the passage of water. If the trench were made firm, and the fissures built up, and then the puddle put behind them, a wall of 4 feet thick should be amply sufficient to support the weight of water. The puddle could not be forced up, because its weight was greater than the water; and it could not be forced into the sides of the trench, because it had been made sufficiently strong. It must, therefore, remain at its original thickness; and if it were reduced to half, it would be amply sufficient to support the pressure of water and prevent its leakage even better than concrete. With regard to making concrete water-tight, his own experience in this work was that there would be a crack about every 30 feet in concrete exposed to the air. This crack was a very material opening, and it must be counteracted. As they might possibly know, in the long aqueduct at Staines this was counteracted by expansion joints laid in asphalt at every 30 feet of brickwork, which prevented the cracking of the concrete. These channels were water-tight throughout, with some small exceptions. In the large tank the loss was only 150,000 gallons a day, and a considerable quantity of this was due to evaporation. In his own practice, he had put in the broken stone or concrete, then filled the interstices with water, and (having previously watered it) added the same quantity of sand *plus* a little for loss. He had found that when this system of measurement had been adopted, the concrete was perfect and homogeneous—he would not say water-tight, because it was almost impossible with concrete used, as in commercial practice, in the proportion of 5 or 6 to 1, to make a perfectly homogeneous mass. He thought, if it was desirable to make a truly water-tight wall, this might be best secured by having a very much thicker layer of richer material on the side exposed to pressure. The difference in cost was very small, and an exceedingly strong wall in the sense of resisting water was obtained at a comparatively slight increase in cost.

In replying to the various speakers, Mr. Watts said he agreed with Mr. White's remarks in regard to the ramming of cement; and he used to do it in his own testing. As to the elasticity of puddle, mentioned by Mr. Clemesha Smith, and its greater reliability compared with concrete, of course this was due to the make in one case and the quality in the other. In the early part of his career, he had had charge of eight trenches, all of which were filled with concrete; and they were absolutely water-tight now. A great deal necessarily depended on the way in which the work was supervised. If men were organized as they should be, and had the right stuff to work with—having an inspector at the top to see that it was rightly mixed, and another at the bottom to take care that it was properly levelled—there need be no fear as to having good concrete. He was exceedingly obliged to Mr. Middleton for his remarks on the subject of the paper. At the same time he could not agree with his ideas as to narrow trenches. He thought that the margin of safety in a puddle trench was not sufficient. With regard to cracks occurring in concrete at distances of 30 feet, and expansion joints being put in, he might say he had at present two trenches in hand, one 500 yards and the other 450 yards in length; and during the whole time they had been refilling, he had never seen a crack of the kind referred to by Mr. Middleton. He regretted to think of the possibility of cracks occurring, as the future of concrete trenches would thereby be condemned. As to narrow trenches, there was very little knowledge in regard to the hydrostatic pressure which a cubic foot of puddle would resist. In making puddle, from 15 to 20 per cent. of water was required in order to produce a proper mixture. Water did not resist water in that case, but had to be pressed out; and this was the secret of puddle trenches settling.

THE ADMINISTRATION AND CONTROL OF THE NATION'S WATER SUPPLY.

By R. E. Middleton, M.Inst.C.E., &c.

[Abstract of a Paper read before the British Association of Water-Works Engineers.]

A river frequently forms the dividing-line between two or more counties, and in all probability each county embraces the whole or parts of more than one drainage area (accepting the definition in its broadest sense); while, on the other hand, the whole of any such drainage area may include many counties and parts of counties. As a result, the interests of such purely arbitrary divisions as counties, made without reference to topographical considerations, are in many cases antagonistic in regard to questions of purification, water supply, and drainage; and the position taken up by some county councils with reference to the question of water supply is absolutely untenable, and would, if carried to a logical conclusion, leave adjacent counties with practically no supply of water at all.

As is well known, there is no ownership in water, either above or below ground. Where water runs in a "defined channel," a right of user exists, with an obligation to return the water to the stream after use in undiminished volume (except so far as it may have been consumed by the inhabitants and by animals), and presumably in an equal condition of purity. The most limited user does not fully comply with either condition, as water is frequently evaporated as steam and otherwise alienated without return; and there can be no doubt that the right, especially as regards purity, has been abused. It would, however, be a still greater abuse of the rights of the population if, as is suggested by some, an ownership in water were set up. An ownership cannot exist in an unstable commodity which, except in a pond or reservoir without overflow or outlet, does not remain in the same place for even a second of time. On the other hand, any complete drainage area has an obvious right to regard the rain falling upon it as its own. This water is of no value to anyone until it has fallen, nor can it be used by any person after it reaches the sea. An authority appointed to control such an area would be in a position to consider, on equal terms, the entire population within its limits; and, having full control of the water supply from its source to the sea, to devote its attention, free from all external interference, to preserving the purity of the water, to providing an ample supply for the use of all the inhabitants, as well as to the disposal of sewage or otherwise polluted water in an efficient and economical manner.

Boroughs and urban districts should offer little difficulty in respect of water supply, since the population within a small urban area makes large demands for water; but if these authorities were assisted by an authority having jurisdiction over the whole drainage area, they would be enabled to give material help to their brethren in rural districts or parishes who might be less favourably situated. In rural districts and parishes the conditions as regards both water supply and drainage are at their worst. The areas of control, having no topographical relation to the question, can seldom be dealt with as separate units, but may have to be either subdivided or amalgamated in sections, which often entails unnecessary expense upon populations the least able to bear the burden. In both of these cases, it is clear that the determination of boundaries by an impartial authority embracing the whole drainage area under consideration would conduce to increased efficiency and economy.

The authorities which it is desired to constitute should have jurisdiction, for purposes of the conservation of the water supply, preservation of fisheries, the prevention of pollution, and the disposal of sewage, over each of the great drainage areas into which the country is naturally divided; the watersheds forming natural lines of separation best adapted for sanitary purposes. The author is also of opinion that these authorities should be responsible to a Central Government Department created *ad hoc*, by whom they would be required to put in force the existing laws for the prevention of pollution, and to whom they should be invited to submit suggestions for the amendment of these laws should this appear to them to be necessary or desirable. The proposed new authorities should be held responsible for the efficient supply of water and the general sanitation of their areas. They should be empowered to subdivide their districts in such manner as might best promote the objects in view; and they should be entitled to enforce on each subdivision the provision of all the requirements referred to. On the failure of the sub-district to comply with its obligation in this respect, they should have authority to carry out the necessary works themselves, either by means of a Private Act or such other method as might be deemed sufficient to prevent injustice to the defaulting bodies. Another important duty might be very properly placed upon the new authorities—viz., the collection, verification, and tabulation of rainfall and other meteorological statistics, the gaugings of rivers and streams, the measurement of varying water-levels in wells, the provision of statistics of water supplied, the capacity of reservoirs, &c., and the level of water therein, and other data bearing upon questions of public health. The information thus obtained should be submitted periodically to the Central Department, by whom it should be tabulated and published.

The author has placed the prevention of pollution of rivers,

streams, springs, or wells first in his list of requirements, because though a supply of water, whether pure or the reverse, is obligatory, and people can, and do, live on impure water, modern ideas of sanitation, as well as the health and well-being of the population, require that the water supplied from all sources shall be pure; and to this end the sources themselves must be protected from pollution. Of late years, owing to the gross impurity of many of our streams, rivers, and wells, a large number of provincial towns, particularly those at a distance from any of the large inland waterways, have been driven far afield in search of water, and have taken supplies at great expense from distant uninhabited areas where the rainfall is heavy. Last, but not least, there is to be considered the urgent necessity for the prevention of pollution and for purification, which in so many cases has been temporarily lost sight of. The author therefore submits that the creation of such bodies as he has proposed would materially facilitate the conservancy of the nation's water supply, and its economical application to the best advantage of the population; and there would remain but few instances where a community would be unable to obtain a supply from its own drainage area.

The suggestion that Water Boards, responsible to a central authority having jurisdiction over the large drainage areas, should be constituted is no new thing. A reference to the interim report of the Royal Commission on the Treatment and Disposal of Sewage will show that similar recommendations were made by the Royal Commission of 1857, again in 1865 and 1868, and is inserted in the third and fourth reports of Lord Iddesleigh's Commission. The writer urged the substitution of River or Conservancy Boards for the existing sanitary authorities upon the notice of the Society of Engineers in a paper read in 1897, and of the Sanitary Institute in one brought before that body in 1898. It is not the fault but the misfortune of the existing authorities that they are unable to treat any of the questions under consideration to the best advantage, hampered as they are by purely arbitrary, and frequently most complicated, divisions of land; and it is believed that they would welcome a system of adjustment which would tend to simplicity and economy.

There appears to be considerable dissatisfaction with the existing law in respect of underground water; and Parliament has in several recent Acts practically overridden the common law as it stands, with effects which, the writer contends, are not in all respects beneficial. In the author's opinion, the law in regard to underground water does not at present press hardly on individual owners of land who require water for their domestic needs as apart from purposes of trade or manufacture; but it certainly does not seem reasonable that a landowner should be permitted to sink a well or wells and pump therefrom large quantities of water, to be dissipated into the atmosphere as steam, or sent away as beer for his personal profit, while his neighbour, who only wants water for the use of his household, should thereby be obliged either to sink his well to a great depth and at heavy cost, or to put up with a deficient supply. The same or a similar argument applies, if anything in a greater degree, to authorities and companies who sink wells and draw water therefrom for the supply of a community, whether sold at a profit or otherwise. In such cases, it is only reasonable that the owners of existing wells or springs which are depleted by such works should be compensated. On the other hand, it is not reasonable that such owners should claim to be supplied with water free of expense to themselves—that is, at the cost of the authority or company; for the water they previously obtained from their wells involved some outlay for machinery and pumping, and was more liable to contamination than a public supply. An authority having jurisdiction over the whole drainage area, being equally interested in every part of its area, and having the power to keep efficient records of rainfall, gaugings of streams and rivers, levels of water in wells, &c., would be far better qualified to deal with these questions than any existing authority having merely local jurisdiction and interests.

Another important question is that of waste, which may be considered under three aspects—viz. (1) domestic waste, from cisterns, taps, flushing tanks, and in the unnecessary watering of gardens, even though the supply be metered; (2) water pumped from excavations like the Mersey and Severn Tunnels, from wells and pits in course of sinking, or permanently from pits and underground workings; and (3) water the use of which has been secured to a particular town or district which is unlikely, within a reasonable time, to require so large a supply. With respect to the first, the suggested Boards would be able to bring pressure to bear on the different areas of supply to reduce the waste to a minimum; as to the second, the cause of loss, being within one drainage area, could be dealt with more effectually than where many authorities had to be brought into line; while in regard to the third, the advantages of making the district of supply coterminous with that of demand, and placing both under the administration of one authority, are obvious.

The author further suggests that the constitution of the proposed Boards should be the first step taken towards the revision and codification of the general sanitary and water-works law, as he is confident that with their constitution many of the difficulties which now exist would disappear. On the other hand, as soon as they had become fully acquainted with their duties, they would undoubtedly be able to give valuable assistance to the Central Department and to Parliament in the inquiry into the existing general law which should certainly follow.

The Royal Commission of 1893 in their report (paragraph 180) stated that water-works should afford information as to the level of water in wells, &c. The writer agrees with this view, if it be also required by public statute that the Central Department and the River Boards, on obtaining particulars as to the rainfall in the district, the quantity of water consumed, the rate of evaporation, and other meteorological statistics, the level of water in wells, the flow in streams, &c., shall print and publish them for general use. The scarcity of such information available at the present time involves much needless expense to all parties interested, and is often responsible for the waste of money on schemes which, with fuller knowledge, would never be attempted.

It has been a source of satisfaction to the author to find that the Royal Commission on Sewage Disposal appointed in 1898, to whom the President of the Local Government Board referred the points brought before him by this Association and other bodies in 1902, has already recommended the formation of River Boards and a new Central Authority much on the lines advocated for several years past and outlined in the present paper. It is also understood that Mr. Long proposes to introduce a Public Health Bill with a view to remedying the defects acknowledged to exist in the law as it stands. Though the terms of the Bill have not yet been made public, his experience on all questions relating to the public health, and the particular interest he has already shown in the whole matter, afford a substantial guarantee that the proposed Bill will effectively deal with every point at present requiring attention. It may, however, not be without effect to again bring this important question forward for public discussion, if only to emphasize the urgency of the case for reform of the present chaotic and extravagant system under which the sanitary affairs of the country are administered.

Discussion.

Mr. C. E. JONES (Leyton), in response to an invitation from the President (Mr. J. Bancroft), opened the discussion on the paper, the subject of which he dealt with two years ago. He expressed his pleasure at the prospect of the points raised by the author and himself being dealt with by the Government. The need for reform had been emphasized throughout the length and breadth of the land in the cry of oppression against those who had secured large areas of water supply which there was no likelihood of their using for years to come. They had only to keep on pointing to the advantage of the nation's water supply being under some central control, to convert every reasonable person to some reform of the present system. The subject before them was a difficult one; and the longer it was delayed the more complicated it became. Whichever body was selected as the controlling authority—whether the Board of Trade or the Local Government Board—it should have power to do various things which were suggested in the paper. With regard to the tabulation of particulars, this had been advocated by the Association since its formation; but without the publication of such tabulations the information would be valueless. To leave this matter to local authorities, he said again, would be a great mistake, because of their different and conflicting interests, and the jealousy displayed among them on all questions affecting watersheds in which they were interested. The importance of the subject was evident; and it was of sufficient moment to justify the constitution of a separate and independent Board with full powers. The nation's water supply ought not to be left in the hands of a few local communities.

The SECRETARY (Mr. Percy Griffith) remarked that the general position of the Association upon this question had been comprehensively and broadly brought before them in the paper. The members knew they had had the subject constantly before them; and the views which Mr. Middleton had put forward practically represented the cream of all they had been talking about and fighting for for some years past. He wished to make a remark on one point, otherwise some of the members might go away under a misapprehension as to the position of the Association. They had, as they knew, many members representing water companies. While talking of water authorities, they included the interests of water companies; and though, perhaps, there was a tendency in the direction of universal municipalization, he wished to assure the members that the Association would never take such a position as that. They were endeavouring to advance the interests of water companies as well as of water-works owned by local authorities.

Mr. W. PHELPS said he had had to advise the Somerset County Council in a case in which another authority was taking water out of the county. The County Council opposed the Bill, and eventually came to an agreement by which all the country districts on the line of the aqueduct should be supplied at a certain rate. This had been very useful. He had hoped to have with him that day the Chairman of the Committee who had conducted this business, who was of opinion that the central authorities of counties ought to have some control over the water supplies, and a voice in the diversion of any such supply from one locality to another. He wished to emphasize the necessity of the new bodies being created out of the existing authorities, especially the County Councils.

Mr. BAKER (New Jersey) said the subject under discussion was one that was becoming pressing in the United States, which were confronted by the same difficulties in dealing with the question, owing to the fact that the nation as a whole had no jurisdiction in these matters except as to inter-State streams. The few States

that were taking up this matter from the sanitary standpoint had done one of two things—they had either delegated the supervision of the pollution of streams and inland water generally to the State Board of Health, or they had instituted a State Sewage Commission. At present there was only one such Commission, and that was for the State of New Jersey. The Commission had complete control over the whole of the municipalities and manufacturing firms in the State, and by statute had authority at any time to order the construction of sewage purification works; and all plans for new sewage works must go to them for approval. In Ohio and New York, the State Boards of Health passed all plans for water-works and sewage systems; and in Massachusetts the matter was dealt with by the State Board of Health before the Legislature would decide upon them. This was the pioneer State which had done much to conserve the State water supply.

Mr. W. WATTS (Sheffield) remarked that the paper must be regarded, not by its bulk, but by the full matter of a very interesting kind which it contained. With regard to the gauging of rain and rivers, he had advocated this in other ways for many years; and at the present time he had a self-recording gauge in the Little Don Valley measuring the water from the drainage area of nearly 10,000 acres. Such records were extremely valuable, because they showed the minimum and the maximum amount of flow—how long the maximum flow existed, how long it was in rising, and how long it was in passing away. To a water-works engineer, such information was extremely valuable, especially when comparing stream gauges with rainfall gauges, as the richness and poverty of a drainage area was learned. He had no sympathy with corporations taking over large drainage areas so many years in anticipation of their wants. He thought it was a mistake; and there was no doubt whatever if a Central Board were formed, this condition of things would be minimized or done away with.

Dr. THRESH said he had to consider the question before the members from two or three different points of view. He thought if Mr. Middleton believed that Boards would be formed with the powers he anticipated in connection with water supplies, he was likely to be seriously mistaken, unless more influence was brought to bear on the Local Government Board than had at present been done. His idea was that their duties would be confined almost entirely to pollution. He was told there were so many conflicting interests that no feasible way had yet been found to form Boards which would obtain the sanction of Parliament if there was likely to be a large amount of opposition when the Bill for carrying this out was introduced into Parliament. The larger authorities were jealous of each other, and the smaller the authority the greater the jealousy. He should be disappointed if some power was not given to improve the water supply in small districts; and this was what would happen unless some body like the British Association of Water-Works Engineers brought pressure to bear on the Local Government Board. If no action could be taken on the paper beyond that of merely educating the public, he did not think they would take full advantage of the opportunity offered them.

Mr. MIDDLETON, in reply, remarked that Mr. Jones had referred to the grasping by authorities, and by others if they could do it, of larger drainage than they could utilize within a reasonable time; and Mr. Watts had alluded to the same thing. That they should take these areas for an unreasonable time should not be allowed; but to take them for a reasonable time was only common prudence. He thought that the practice of Parliament was to make provision for 15 years in advance, which was only right and proper. What was wanted was some means of limiting grasping and ensuring a sufficiency for all. Unless there was a proper system for the prevention of pollution, there would come a time when the country would not have sufficient water. They could not perpetually go to upland uninhabited areas which were said to be so much superior to rivers as sources of supply. If the rivers were properly conserved, they could be returned to their original use of supplying water; but they must be freed from pollution. As to the constitution of the proposed Boards, he had already stated that, in his opinion, they should be formed from the existing sanitary authorities, including the County Councils; and if they were formed from the existing Boards, he should like to see the jealousies which undoubtedly existed, and which prevented amalgamation at the present time, disappear—not all at once probably, but in a very short time. He quite agreed with Dr. Thresh that unless steps were taken to enforce upon the country the opinions of water-works engineers, and those who were interested in sewage and the prevention of pollution, nothing would be done. It was true that the formation of Rivers Boards had been mentioned; but it was in connection with the pollution of rivers, and not with the supply of water. Was it not possible for the Association to amalgamate for this particular purpose with others, or, if this were not possible, to take steps on their own account to notify to the Government the strong feeling existing on this subject? He hoped it would be possible; and it was with the object of bringing this important matter before the members that he had written the paper. With regard to the collection and publication of statistics, he wished others would take records of drainage areas similar to those mentioned by Mr. Watts, as their value was enormous. As to the division of areas, this was one of the most important duties which a Central Board such as he had suggested would have to undertake. At present the Local Government Board had powers with reference to this matter; but the Department occupied a different position from the Board he had proposed, the establishment of which, or of something similar, he trusted all would strive to bring about.

On the motion of Dr. THRESH, it was agreed that it be an instruction to the Council of the Association to consider the question of the constitution of the proposed Water Boards, and the powers to be delegated to them, with the object of bringing the views of the Association before the President of the Local Government Board.

REGISTER OF PATENTS.

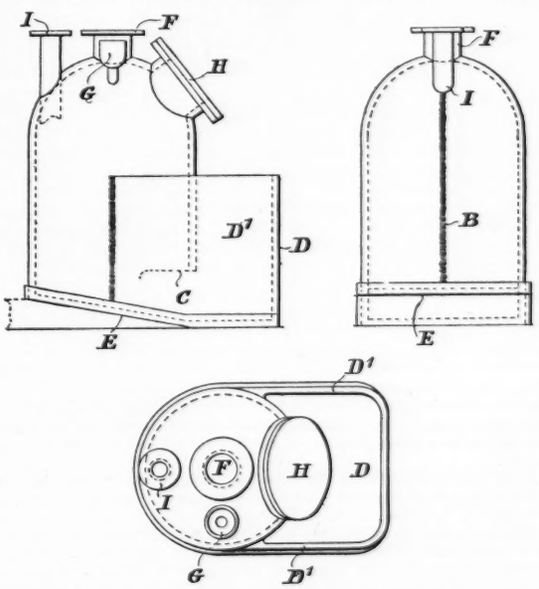
Manufacture of Gas.—Woodall, H. W., and Duckham, A. M'D., of Bournemouth. No. 16,497; July 27, 1903.

This invention is referred to in an article published in another column to-day, p. 26.

Sulphate of Ammonia Saturators.—Schwab, M., of Blackfriars Road, S.E. No. 17,585; Aug. 13, 1903.

The patentee describes an ammonia saturator comprising a body and top wrought in one piece of lead, a fender formed separate from and united to it, and a bottom extending under the body and fender—an aperture being formed at the base of the body so as to provide a passage between the body and the fender.

As shown, the body of the saturator is formed from a rectangular



sheet of lead by bending it into a cylinder and burning or otherwise uniting the abutting or overlapping edges as at B. The top of the cylinder is then beaten into a dome. An aperture C is formed in the front of the body so as to face the fender D when this is united to the body, and to provide a passage between the body and the fender. The fender is formed by bending a sheet of lead as shown and burning or joining the wings D^1 to the body; and the bottom E is burned or joined to the body and fender D. F, G, H, I are the manholes and other usual connections in the dome of the saturator.

Conveying Coke, Coal, Breeze, Ashes, and other Substances.—Johnston, A. A., of Ilford. No. 15,205; July 9, 1903.

This invention relates to improvements on the invention No. 13,343 of 1903, next described, and consists in the use of compressed air or compressed air in conjunction with either water or steam according to the nature of the substance to be conveyed. For instance, in the case of the conveyance of hot coke (as it is desirable that the coke shall be simultaneously quenched), it is preferred to employ either water or steam in conjunction with the compressed air. The compressed air or compressed air and water or steam is supplied to nozzles placed within a trough, pipe, or conduit into which the material to be conveyed is delivered in proximity to the nozzles. The arrangement of apparatus will depend upon the special circumstances of each case; and in cases in which compressed air is used in conjunction with either steam or water, any suitable form of compound nozzle may be employed in which the passages and exits for the compressed air and steam or water are arranged concentrically or in any other suitable manner with respect to one another.

Conveying Coke from Gas-Retort Benches and Quenching Same.—Johnston, A. A., of Ilford. No. 13,343; June 15, 1903.

This invention has been devised with "the object of dispensing with a mechanical conveyor and its attendant disadvantages;" the patentee proposing to employ for the purpose stationary apparatus, in which a number of jets of steam or superheated steam is used as the motive agent and quenching medium.

Fig. 1 (p. 38) is to show the invention applied to a bench of inclined

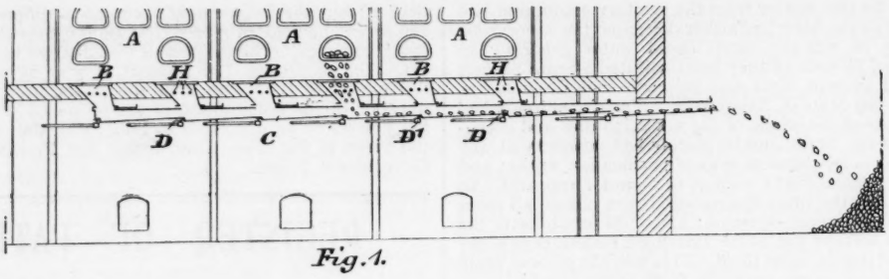


Fig. 1.

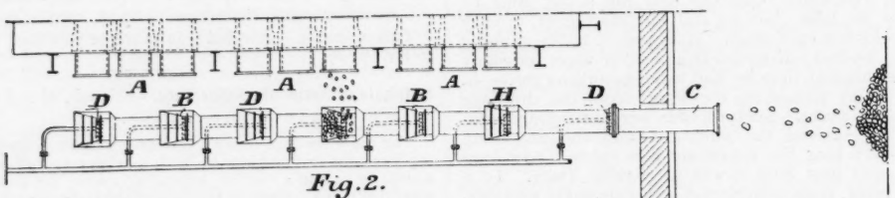


Fig. 2.

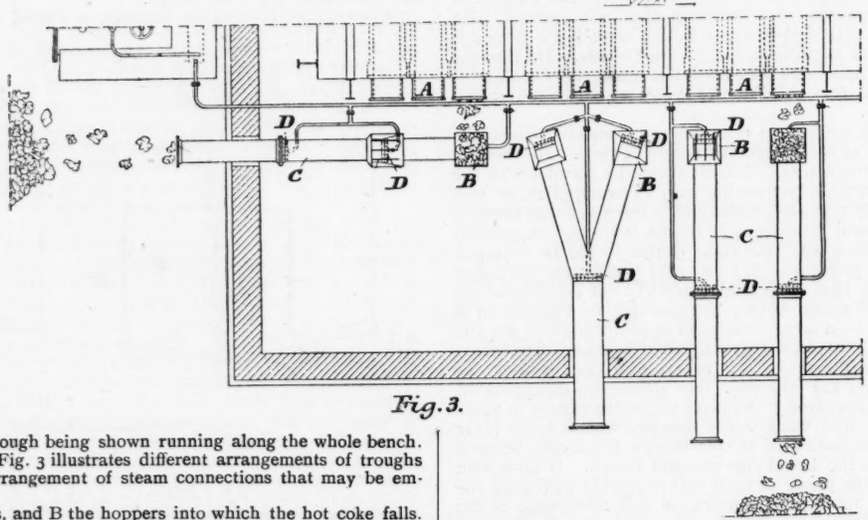


Fig. 3.

retorts; a single trough being shown running along the whole bench. Fig. 2 is a plan. Fig. 3 illustrates different arrangements of troughs and the general arrangement of steam connections that may be employed.

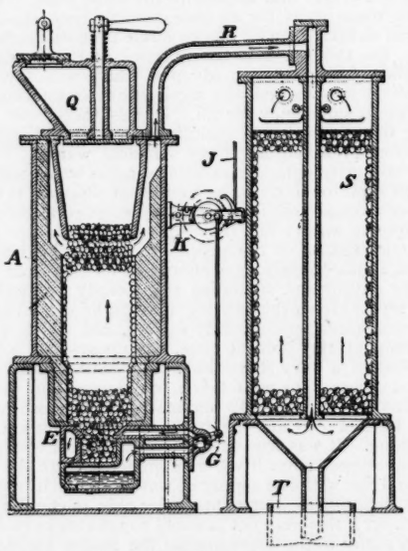
A are the retorts, and B the hoppers into which the hot coke falls. C is the trough or troughs placed beneath the hopper or hoppers, and arranged in different ways, as may be found most suitable. For instance (as in figs 1 and 2), only one trough is employed, running along the whole bench of retorts and terminating at one side of the retort-staging. But each tier of retorts may have a separate hopper and troughs or there may be two tiers of retorts, with separate hoppers in line with one another and opening into a single trough. In either of these cases the trough would be continued to the front or side of the retort-staging as shown on the right and left hand of fig. 3. The separate troughs belonging to two or more tiers of retorts may in certain cases be merged into a common terminal trough, as in the central part of fig. 3.

In proximity to the lower ends of the hoppers B, and between the overlapping portions of the trough sections C, one or more rows of steam-nozzles D are placed. The steam-nozzles D are arranged side by side, parallel to the trough axis, and in the direction in which it is desired to convey the hot coke; and they are protected from the falling or passing coke by the overlapping portions. Inlets are provided by means of which a suitable supply of air can be drawn into the trough or troughs by the steam issuing from the nozzles D.

When it is desired to convey away the charge of hot coke in any retort, the cover of the hopper underneath the retort is removed, the slide of the hopper is opened, the other or inoperative hoppers (if any) connected with the troughs are cut off from communication with the air, steam is supplied to the nozzles, and the coke is allowed to fall into the hopper. The falling coke is driven or moved along the troughs by the steam issuing from the nozzles and the rush of air induced thereby, is conveyed to the end of the trough, and drops into trucks placed underneath or on to the ground, as desired. "The issuing steam at the same time quenches the coke, and, together with the induced air, acts as an elastic cushion upon which the coke falls—thus minimizing breakage."

Gas-Producers and Purifying Apparatus for Use with Gas-Engines.—Delassue, J., of Paris. No. 27,579; Dec. 16, 1903.

This invention has reference to gas-producers subject to the direct suction of the gas-engine piston—a form of apparatus which, the patentee remarks, is becoming more and more recognized as the most desirable solution of the problem of obtaining motive power, on account of the absence of danger and their great economy, which is such that no other practicable sort of energy can compete against them. There are, however, as he points out, still certain inconveniences to be overcome, among which may be mentioned the imperfect automatic regulation of the steam supply to the producer, and the fact that the apparatus for washing and purifying the gas has to be very bulky if it is to be effective. Moreover, the wear and tear on the opening or tuyere for the entry of air and steam at the bottom of the producer rapidly sets up disturbances in the regular action of the producer by reason of the increase in diameter of this opening.



The apparatus is composed (as shown) essentially of a gas-producer A, and a purifier or purifying apparatus S, serving both as a condenser or cooler and also for washing or scrubbing the gas. The producer comprises a cast-iron body provided internally with a fire-brick lining, which contains the charge of fuel resting on a hollow sole or bottom, which forms the evaporator for generating the steam to supply the producer. Between the body and the bottom is arranged a cast-iron ring-piece, wherein is the tuyere opening through which the air and steam are drawn into the producer. The opening is kept at such a temperature that the metal is not liable to be attacked by the steam; and to

this end the ring-piece is made hollow and has a downward projection or off-set, so that it will be in contact with the evaporator at certain points and will be thereby kept cool. It is, furthermore, cooled by the passage through or round its interior of the steam which it serves to deliver to the producer.

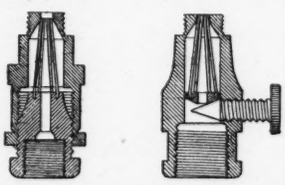
The steam produced in the evaporator flows to the regulating cock G, and from there returns into the ring-piece E, whence it passes out by some small holes, so as to be drawn through the opening shown after being mixed with the air. The evaporator has an upward projection on its right corresponding to the downward projection on the ring E. Hence the superposition of the latter on the evaporator forms between the projections a passage of rectangular section open at each extremity. It is by the open ends of this passage that the air enters the producer, and that the bottom of the furnace is cleaned out.

In order that in a producer where the gas is aspirated directly by the piston of the engine the action of the latter may always be regular, it is necessary, when the engine is working with a full charge, that the admission of steam should be at the maximum; and when the engine is working with a variable charge, that the proportion of steam passing into the producer should be diminished accordingly, and in proportion to the smaller demand of work of the engine, until finally the introduction of steam is completely stopped, when the engine runs light without taking in its charge for (say) three or four cycles. This result is obtained by causing the steam issuing from the evaporator (for delivery into the bottom of the producer) to pass through the regulating cock G, which is so set that, when the motor is running light, it occupies such a position that all the steam escapes by the orifice shown, and never enters the furnace. In proportion, however, to a greater demand of work upon the motor, the cock turns, and so brings the two steam passages into communication. In this movement, more and more of the steam is sent into the producer, and less and less escapes by the orifice.

The fuel or coal is introduced, during working, into the gas-producer by an air-lock Q having a double-closing arrangement, and the gas passes from the producer, by the passage R, into the washer or scrubber S. This latter is composed of a column of coke separated into two parts by walls or webs, which have left between them a space for the passage of the gas coming from the producer. These walls, kept cool by the washing water which is sprayed on to the column of coke, serve to cool the gas, and the products of condensation fall into the waste-pan T along with anything carried away by the wash-water.

Gas-Burners.—Altmann, F., of Berlin. No. 5733; March 8, 1904.

This invention relates to gas-burners the essential feature of which consists in arranging within, and vertically of, the body of the burner a number of wires, bristles, or the like, by the adjustment of which, or of a cap, the cross area of the gas outlet can be regulated so as to control the escape of the gas.



In the first arrangement shown, the body of the burner, to which the wires are fixed, is covered by a cap, which is externally screw-threaded to fit over a corresponding external thread on the body. The gas outlet formed in the cap encloses the wires with their outer extremities in, or adjacent to, the narrow neck of the outlet, in such a manner that, by adjusting the cap by the screw-thread on the body, the wires may be contracted within it by screwing up, or expanded to increase the outlet by unscrewing the cap.

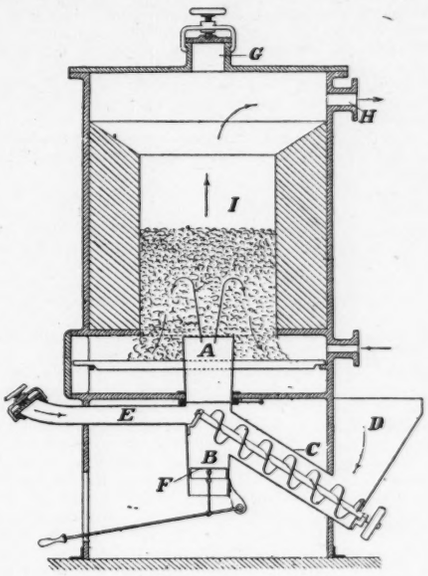
In the second modification, the body and cap are formed in one piece, and the wires are mounted upon a base piece loose within the cap portion of the body with their outer extremities (as before) in or adjacent to the gas outlet. An adjusting screw is carried by the body of the burner, with its extremity in contact with the loose base-piece of the wires or bristles, so that by operating the screw the wires are raised or lowered within the cap portion of the body, and their outer extremities contracted or expanded within the narrow neck of the gas outlet, to diminish or increase the supply of gas.

Producing Poor Gas Free from Tarry Matters.—Boutillier, L., of Paris. No. 9942; April 30, 1904. Date claimed under International Convention, Aug. 14, 1903.

This apparatus "allows of the distillation of the volatile substances contained in the combustibles being effected before the combustibles are charged into the furnace; the volatile products arising from this distillation being utilized in the same furnace for assisting in the production of the poor gas."

The vertical distilling retort A is arranged in the hottest region of the furnace; and its upper part ends at the level, or a little below the level, of the layer of incandescent combustible which the furnace contains. The lower part of the retort discharges into a vertical cylinder B, from which it may be completely separated by a damper adapted to be operated from the outside. The cylinder B communicates with the upper part of a pipe C, containing an endless screw actuated automatically in any suitable manner, and connecting at its lower part with a hopper D serving to contain the combustible. The cylinder B may also communicate with a pipe E, the free end of which is closed by a stopper; the two pipes C and E serving to feed the retort with combustible to be distilled, which feed is effected, either in a continuous and regulateable manner, by means of the screw or, in an intermittent manner, by means of a piston F actuated by a lever operated from the outside, and forcing into the retort the combustible introduced into the cylinder B by the pipe E.

The lighting of the fire is commenced by introducing combustible by the charging-hopper G, and the retort is filled with combustible to be distilled. Before collecting the gas by the pipe H, it is preferable to wait until the temperature has become sufficient for the complete distillation, and the feeding of the furnace with the combustible by the retort is continued. For this purpose, the introduction into the furnace of the combustible contained in the retort is regulated so as to be certain that this combustible has completely distilled off all its hydrocarbons; and this introduction of distilled combustible is effected either continuously by means of the screw in C, or intermittently by means of



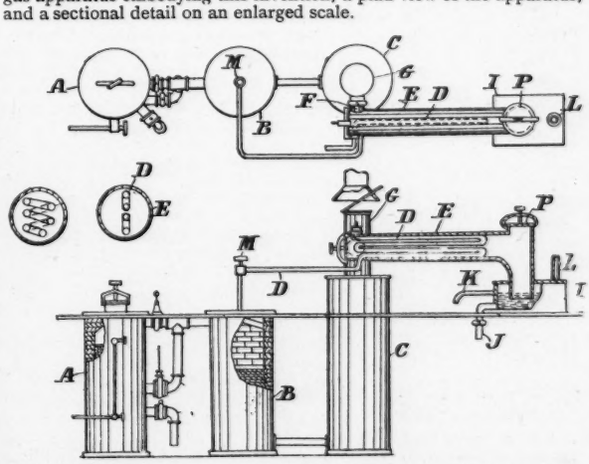
the piston F. In the first case, it is evident that is is possible to regulate the speed of rotation of the screw in such a way that the fresh combustible, which it continuously pushes into the retort and from there into the furnace, remains in the retort the necessary time to allow of its hydrocarbons being completely distilled off. In the second case, at the moment of feeding, the slide below the retort is opened to allow the combustible introduced into the hopper B by the pipe E to pass into the retort.

The combustible thus introduced into the retort is distilled under the action of the heat which the retort receives from the very hot region in which it is arranged; and as it discharges at the level of, or a little below the level of, the layer of incandescent combustible contained in the furnace, the hydrocarbons arising from the distillation effected in the retort are forced to pass through the incandescent layer, which reduces them before their entrance into the generator I. The combustible thus distilled then again descends into the furnace, as explained, and is there completely burnt.

Manufacture of Carburetted Water Gas.—Addicks, W. R., of New York. No. 10,723; May 3, 1904.

This invention relates more particularly to the heating of the oil or hydrocarbon employed in water-gas apparatus, whereby the formation of lamp black or deposits of heavy hydrocarbons in the carburettor are avoided or largely diminished, so that the fixed gases are free from lamp black, tar, or carbon particles, "which enables the gases to be utilized for heating the apparatus through which the oil is supplied to the carburettor without the necessity of frequent cleansing of the apparatus or heater."

The illustrations show, in elevation and section, a carburetted water-gas apparatus embodying this invention, a plan view of the apparatus, and a sectional detail on an enlarged scale.



A is the generator, B the carburettor, and C a fixing-chamber of any usual construction. The carburettor has connected with it an oil-heater comprising preferably a coil of horizontal pipes D located within a horizontal pipe E connected by the branch pipe F with the outlet pipe G for the fixing-chamber. The pipe E is closed at its front end by a clean-out cap or cover H, and has its rear end bent and extended down into the hydraulic main I, which is provided with a liquid outlet

pipe J, an overflow pipe K, and with a gas outlet pipe L. The series of pipes D (shown as four in number and arranged in a substantially vertical plane) constitute a heater in which light or heavy oils employed for enriching the water gas are heated or vaporized by the gases passing through the outlet pipe E of the fixing-chamber. The individual pipes of the heater are slightly inclined, so that the oil may gravitate through them. The uppermost pipe of the coil or heater is extended through the top or side of the pipe E, and is connected to the source of supply (not shown); and the lowermost pipe of the heater is also extended through the bottom or side of the pipe E, and is extended into the carburettor, into which the oil or vapours gravitate—the pipe being provided with a valve M for controlling the quantity of vapour admitted into the carburettor or mixing-chamber.

As a result of the arrangement shown, "a superior quality of carburetted water gas may be obtained at a minimum expense," it is said, for the following reasons:

(1) The horizontally disposed oil-heater affords a continuous path through which the oil may flow by gravity, thereby avoiding the formation of oil seals or traps in the individual pipes when the heater is cool or not in use, or when the volume of oil is small compared with that of the heater, or when the supply of oil is momentarily interrupted—consequently avoiding the necessity of a high pressure to force the oil through the heater, as would be the case if the heater was arranged in a vertical or upright position.

(2) By reducing the pressure employed to force the oil through the heater, not only is a saving effected in this direction, but, what is more important, the oil is more completely vaporized, as it is exposed for a longer time to a higher heat, and, as a result, the vaporized oil admitted into the carburettor B is of a higher temperature, and in better condition to mix with the water gas, thereby avoiding the formation or deposit of lamp black and tar, which would not only lower the temperature of the carburetted water gas passing from the fixing-chamber C and through the outlet pipe E, but would also be deposited on the outer surface of the heater, which would necessitate frequent and, in practice, many times daily cleaning in order that the oil might be properly vaporized; for it will readily be seen that if lamp black or tar is deposited on the pipes of the heater, the pipes would be practically covered with a non-conductor of heat, which would prevent the gases passing through the outlet pipe E from heating the oil to the degree they would if the pipes were not so coated. By heating the pipes of the heater sufficiently hot to properly vaporize the oil therein, the formation of lamp black is avoided or largely diminished, and, consequently, the gases which pass through the outlet pipe E are substantially free from carbon, tar, &c., and are hotter, and a superior carburetted water gas is obtained.

(3) Furthermore, by reducing to a minimum the pressure in the main oil supply line throughout the gas-house, the leakage of the oil lines due to the pressure, and the danger from accidental fracture of the oil lines, are reduced to a minimum.

(4) The reduction of tar and lamp black decreases the amount of oil used to make a given candle power gas.

It will be observed that access can be quickly had to the oil heater by opening the cap or cover H; and by means of the vertical arrangement of the pipes comprising the heater, their whole area can be quickly scraped if necessary. The bent end or vertical portion of the outlet pipe E is provided with a clean-out cover P, in line with the dip-pipe of the hydraulic main, which affords access to the usual obstructions formed at this point, thereby enabling the obstructions to be easily removed, as the clean-out opening is close to the water level of the hydraulic main, and the passage is not obstructed by the heater.

APPLICATIONS FOR LETTERS PATENT.

13,827.—Grossmann, J., "Obtaining ferrocyanide and ammonia compounds from crude coal gas." June 18.
13,850.—Horowitz, J., "Automatic igniting and extinguishing appliances for gas-burners." June 18.
13,873.—Kay, M., "Inverted incandescent burners." June 18.
13,877.—Hatton, G., "Gas-producers." June 20.
13,880.—Riley, E. C., and Faulkner, J., "Anti-vibrator." June 20.
13,897.—Goodyear, R. J., "Incandescent burners." June 20.
13,970.—Snell, F. A., and Goodridge, R. H., "Self-intensifying gas-lamps." June 20.
14,007.—Diehl, G. C., Showalter, H. M., Grube, W. H., and Showalter, J. W., "Gas-machines." June 21.
14,017.—Fairweather, W., "Internal combustion engines." A communication from the Waite Gas-Engine Company. June 21.
14,084.—Bray, J. W., "Incandescent lighting." June 22.
14,085.—Bray, J. W., "Outdoor pilot-lights." June 22.
14,133.—Bünte, V., "Inverted burners." June 22.
14,164.—Rose, A., "Incandescent burners." June 22.
14,165.—Brons, J., and Timmer, N., "Gas-engines." June 23.
14,171.—Blakey, J. W., "Gas-burners." June 23.
14,288.—Valeriola, E. de, Sepulchre, E., and Moeller, J., "Mantles." June 25.
14,290.—Moeller, J., "Mantles." June 25.
14,295.—Ross, J. H., "Acetylene burner." June 25.
14,301.—Potter, E. W., "Globe holder." June 25.
14,333.—Elworthy, H. S., and Williamson, S., "Gas manufacture." June 25.
14,355.—Gersabeck, E., "Air gas." June 25.
14,383.—Poetter, H., "Gas-producers." June 25.
14,386.—Melhuish, A. G., "Internal combustion engines." June 25.
14,400.—Macfie, D., "Dry meters." June 25.

The East Surrey Water Company, as will be seen by an announcement which appears elsewhere, are inviting tenders for a new issue of ordinary shares.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Flow of Gas in Mains and Distribution at High Pressure.

Sir,—In reply to the letter which appeared in your last issue signed "Inquirer," I beg to say it is far from my wish to enter into controversy with an anonymous correspondent in a public journal; but if the gentleman who has written the letter is really desirous of gaining information upon the subject of "boosting" gas, I shall be very happy to give him full particulars if he will write to me at the address below, or perhaps, what would be better, make a personal call.

G. C. Trewby.

Gaslight and Coke Company, Horseferry Road, S.W., June 29, 1904.

Mixing Breeze with Coal at the Nanterre Gas-Works.

Sir,—I have seen copies of your esteemed paper in which you have been good enough to occupy yourself with me and the Nanterre Gas-Works. Not only do you mutilate my name, which is written Lhomme and not L'homme, but I think you play havoc with my idea. It therefore becomes necessary for me to endeavour to put matters in their true light.

The object of the addition of breeze—not, as one of your distinguished correspondents states, in a "large percentage," but in the proportion of 3, 4, or 5 per cent. maximum—was never, to my mind, to transform it into coke, but to prevent the creeping of the coal in the inclined retorts. I noticed that immediately after the coal had been introduced, the creeping commenced; and I was led to attribute this phenomenon to the movement imparted to the coal by the gases given off. This movement produced in the mass of coal a disturbance of the unstable equilibrium in which the material is found in an inclined retort, and had the effect of a series of vibrations which brought about the creeping as soon as the distillation process commenced. The result of the admixture of breeze with the coal was to prevent this tumultuous liberation of the gases; and, as a consequence, the movement of the coal towards the bottom of the retort was checked.

I likewise noticed that the inclined retort had a tendency to become hotter at the top than at the bottom. This peculiarity may equally be a cause of creeping, but for another reason than that already mentioned. The layer of coal, which is generally not very thick at the top, being subjected to greater heat, is nearly all carbonized; whereas the lower layer is only in a condition of soft paste. The upper part, being carbonized, and not being sufficiently supported by the lower part, which does not offer adequate resistance, slips down by its own weight, and crushes the coal at the bottom against the mouthpiece, and causes obstruction at that place.

To recapitulate, I have noticed two causes of obstruction at the lower end of inclined retorts: (1) Obstruction of the coal in course of distillation, on account of the pressure of the top portion, carbonized, against the lower portion in course of carbonization. (2) Creeping almost immediately after the introduction of the coal into the retort, on account of the disturbance of equilibrium caused by the movement of the coal resulting from the rapid liberation of the gases. In order to remove the first cause, I have endeavoured to obtain a simultaneous distillation throughout the entire length of the retort; and to achieve this result I have had to lower the heats slightly in the upper part of the retort. But there is nothing abnormal in this reduction. It is about the same as is found in single horizontal retorts between the back of the retort and the mouthpiece, and between this and the middle in the case of through retorts. This settles one point. To remove the second cause, I have added from 4 to 5 per cent. of breeze; but I repeat that I do not pretend to bring about the "regeneration of the breeze" as some of your correspondents seem to think.

I may add that the results obtained are very satisfactory. The whole coke produced is broken (and it may be said that coke is not sold in any other way in the neighbourhood of Paris); and its quality is not deteriorated. How, indeed, could it be, with so small a proportion of breeze? It is as hard and as saleable as that which we previously sold at the Rueil works with horizontal retorts; and our proportion of breeze tends rather to decrease than to increase. We can carbonize at Nanterre in our inclined retorts all kinds of coal in lumps, unscreened, or dust, and from any source. The result obtained is, I think, a conclusive reply to all the arguments brought forward, notwithstanding the eminence of the men who advanced them. Certainly we were very much worried when we first began; and I must admit that life was then barely tolerable at Nanterre. But since the improvements that we have happily been able to introduce as the result of experience, I am pleased to say that we are now able to live in comparative comfort. I wish the same relief to all colleagues who are, or may be, in similar difficulties as I have been, and out of which I think I have fortunately and definitely emerged.

Paul Lhomme.

Nanterre, June 30, 1904.

Contractor-Engineering.

Sir,—I do not wish in any way to come into contact with the points at present at issue in your columns between Mr. H. E. Jones and Mr. Maurice Graham.

With regard to Nanterre, I have had an opportunity of seeing these works, and have no hesitation in saying that, from end to end, they are a credit—to the designer or designers, whomsoever he or they may be, whether French or English—as a capital instance of sound modern gas-works engineering. I did not inquire to whose credit they stood, and neither Nanterre nor any of its sections are my point.

A sentence in the letter from Mr. Jones dated June 25, bearing on these works, however, caught my attention: "I shall have plenty to say presently, *re* contractor-engineering;" and I am looking forward

to an early exposition of the ex-President's views on this interesting phase of present-day gas-engineering life.

In the meantime, if any gentleman, from either "Contractor-Engineers" or the "Engineer's" side, who has the data readily available, can give us the records of such up-to-date specialities as carburetted water gas, mechanical stoking machinery, inclined retort installations, the different types of guides for gasholders, conveying and elevating machinery, and a plenitude of other processes and systems—of the source from whence each took its being, and what is of still greater importance, from a commercial point of view, to whom is due the development of its practical and mechanical details of construction—it would be of great value to many people interested in the progress of the industry.

Let us give honour to whom honour is due, and try at least to avoid shouting "Anathema, Maranatha" at the best endeavours of honest commercial or industrial firms to place good types of plant on the market simply on the ground that such efforts emanate from a commercial basis.

There is nothing to be gained by turning our "blind eye" to the facts. I am fully aware that I am liable to be told that the line I have taken is quite away from the point. That what is desired and required is "Protection," so that shareholders and directors may not be placed at the mercy of any firm or firms of contractors, through the acceptance of plant specially designed by them to meet their own ends.

This position no business man, or body of business men, could for one instant accept knowingly, as a right or honest policy. Still, we must look at the matter in a very broad light; and I think such information as I have indicated would enable those interested—be they directors as shareholders, shareholders as a body, or ratepayers, the people who provide the money, in other words—to form a better judgment on the merits of the case as it stands.

We may, I suppose, take it that the *Ultima Thule* to work for is the getting of the best types of plant and apparatus required to serve the end desired—*i.e.*, good and economical working results, at the lowest marketable cost, compatible with good material and sound workmanship, irrespective of the source from which it comes—engineer designed or contractor-engineer designed.

The elevation of the status of the members of the gas industry as sound engineers and designers is very much to be desired, and is a very right position to work for, in its degree; and I am sure all are anxious to see any scheme to this end developed, and speedily developed. There is, however, another side to the question. The process may prove costly, if carried too far (as in the other position) to the shareholders, ratepayers, and, still further, to the consumer, who has also to provide his proportion of interest on over-capitalized works.

It is not difficult to place the finger on many works where the designs of buildings and plant have come from the drawing office of the expert, and been successful works when put into operation, but have required many strokes of the pen on the cheque book in the putting, when a little co-operation with the contractor-engineer would have reduced the score by many strokes.

Hull, June 29, 1904. J. HOLLIDAY.

Mr. H. E. Jones and the Nanterre Gas-Works Installation.

SIR,—Mr. Jones's jumble of June 25 is so lame, so inconsistent, so inaccurate, that it calls for no reply from me.

Leeds, June 29, 1904. MAURICE GRAHAM.

Incandescent Gas Lighting at Plymouth.

SIR,—I regret to note by your remarks upon what I said at the annual meeting of the Plymouth and Stonehouse Gas Company, that my meaning was not quite clear. Of course, I am quite at one with you in the opinion that incandescent lighting came to the rescue of the gas companies at a very critical crisis in their fortunes. What I wished to emphasize was that, as incandescent lighting is becoming more popular in working-class localities, the substitution of this burner for the flat-flame burner in those particular instances means a considerable reduction in the consumption, which has to be set off against the general increase from cooking, heating, and the natural growth of the town.

Plymouth, June 30, 1904, J. A. BELLAMY.

Stops—Not Slots.

SIR,—I have read with interest the articles headed as above and published in the "JOURNAL" for April 5 and 12.

Though I may (owing to distance) be late with my query, I should like to ask a question which has probably occurred to many other readers—why, on a weekly collection, there should be any necessity for either slots or stops. It does seem to me that, if it pays to come to such fine lines as a weekly collection, suppliers of gas could afford to take on the risk of a small loss possible through a week's credit, provided the consumer placed himself, by agreement, in the position that the collector could summarily cut off the supply if the week's cash was not forthcoming. Under such circumstances, all that appears to be required is the rearrangement of the ordinary index gearing and dials, whereby units, tens, and hundreds of feet would be shown on the three dials, instead of the quantities now indicated thereon. The collector would revert to the ordinary practice of debiting his charge as shown by the progressive register of the index, and none of the weak points associated with the use of slots or stops would arise.

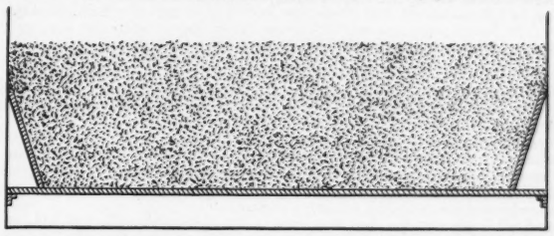
G. J. COX, Chief Meter Inspector.

Melbourne Gas Company, May 25, 1904.

Arrangement of Grids in Oxide Purifiers.

SIR,—I have recently adopted a slight modification in my purifiers. Mentioning the matter, incidentally, to a gentleman interested in purifying material a few days ago, he thought it might be helpful to others; so I venture to record it.

I place the oxide in one layer or mass (4 feet thick), instead of in two or more layers, and utilize some of the grids by placing them alongside the purifier-box in a diagonal position—thus largely increasing the area of the space for the passage of the gas without taking up the room of the purifier. The annexed sketch will enable every practical man to



see at a glance the effect this has upon the fuller utilization of the mass of oxide, and the prevention of back-pressure before it is spent; and anyone may adopt it for his own use, and save the expense of either Cripps's or other grid-valves, Jäger or "Standard" grids. Of course, the extent of the advantage to be gained will be modified or limited by the size of the purifiers.

East Grinstead, June 27, 1904. D. T. LIVESEY.

Workmen's Breakfast Time.

SIR,—During the great strike of the engineers in 1897-8 for an eight hours day, it was said that the men would have breakfast before beginning work at 7 o'clock; but at that early hour it could only be a lonely and comfortless meal. This raised the question whether the usual half hour at 8 o'clock is enough for comfort; and the answer was in the negative. Possibly, when businesses were small, and men lived at or close to their work, it might have been sufficient; but those conditions are gone. The Directors of the South Metropolitan and Crystal Palace District Gas Companies, therefore, increased the breakfast time to three-quarters of an hour (without reduction of pay) to all ordinary workmen—excepting retort-house men and some others to whose conditions of work the question does not apply—in order that father, mother, and children might have time to get the first meal of the day in comfort together.

Nothing in my experience has evoked warmer expressions of gratitude from the workmen. The Companies also have benefited; for the 15 minutes are more than made up, as the following letters amply prove. These letters are so much to the point that I venture to ask you to print them, as you have always shown such warm sympathy with all that tends to promote the wellbeing of gas workmen. I hope that their perusal may lead others to do likewise. It is not an entire novelty; for I am informed three-quarters of an hour for breakfast is the rule on the Clyde and in some places in England.

June 30, 1904. GEORGE LIVESEY.

STATEMENTS.

SOUTH METROPOLITAN GAS COMPANY,
GREENWICH STATION,
April 19, 1904.

Having received a communication from Mr. Carpenter yesterday, stating that it was your wish that the Engineers of stations should report as to the advantage to the men and the Company of the extra quarter-of-an-hour which you kindly agreed to allow the workmen for breakfast, I have pleasure in stating there is no doubt at all about its being a great boon to the men, and it is recognized by them as such. Before the extension of time, only a few were able to go home to breakfast, whereas now quite two-thirds avail themselves of the opportunity thus afforded and go home. The remainder, who live too far away, have now no excuse for trying to get their breakfasts ready in working time, and, in fact, there is hardly an instance of a man being found preparing his breakfast before the bell is rung; but this was, of course, a common occurrence before the alteration took place. I have no hesitation in saying that none of the men spend any part of the additional time allowed for breakfast in the public house. It is mainly used, as I said above, in going to and from their homes.

J. F. BRAIDWOOD.

SOUTH METROPOLITAN GAS COMPANY,
VAUXHALL STATION,
April 19, 1904.

There can be no doubt whatever that the gift of the additional quarter-hour at breakfast time to the Company's men is most highly appreciated by them.

Six years having elapsed since the change was made, we do not, as you may suppose, hear much said about it now; but at the time great and general satisfaction was expressed, and that it still exists may be known for the asking. I may, perhaps, remind you that the matter was referred to by the workmen at last year's Co-partnership Dinner at the Crystal Palace. Personally, I believe that no privilege granted to the men since 1889 has been more highly prized. It has enabled many more men to get a comfortable meal at home—no doubt at less cost.

As regards results to the Company of the Directors' action, I think that it was, and is, money well spent, and yielding good interest in the shape of contentment and the more efficient service which may be expected to follow automatically upon more comfortable and healthier social conditions.

Finally, there is neither evidence to show, nor reason to suppose, that more time is in consequence spent in public houses; but we do know that some men at least who previously were seen there now go home to breakfast.

The fact is that sobriety has greatly increased in South Metropolitan works—drinking is less in evidence every year.

A. F. BROWNE.

SOUTH METROPOLITAN GAS COMPANY,
TAR-WORKS,
April 18, 1904.

I have been Manager of these works for twenty years, during which time the men have had breakfast from eight until eight-thirty. I can assure you that the extra quarter-of-an-hour which the Company have allowed the men since July last is fully appreciated by all, and is not spent in public houses.

I know in the past from seven-thirty until eight a.m. it was next to im-

possible to keep the men at work, they being so anxious to have things ready so as to start breakfast as soon as the whistle sounded.

All this is now changed, the men leave off work at eight, and are ready to start at eight forty-five. I feel sure the Company have gained by their generous act in giving the extra quarter-of-an-hour for breakfast.

S. S. FIELD.

SOUTH METROPOLITAN GAS COMPANY,
BANKSIDE STATION,
April 22, 1904.

In answer to your query *re* extra quarter-hour for breakfast, I would state that the interests of both the Company and the men have been greatly advanced.

The additional time enables many men to breakfast at home both cheaper and more comfortably than they could either at the works or at a coffee shop.

Others can purchase a wholesome meal instead of merely a "livener" at a public house; the coffee shops being very crowded just at this time, and half-an-hour does not allow for any waiting.

And so I am certain that not only is the general health, comfort, and behaviour of the men improved, but also their average capacity for work increased.

CHARLES FRANKS.

SOUTH METROPOLITAN GAS COMPANY,
OLD KENT ROAD STATION,
April 18, 1904.

Several men have expressed to me the immense benefit the extra quarter-of-an-hour's allowance at breakfast time is to them. It is especially beneficial, in that it enables most of them to have their breakfast with their families in their own homes; thus enabling them to get a much better breakfast, at less cost, than if they brought their breakfast into the works, or had it at a neighbouring coffee shop, or perhaps public house.

With the half-an-hour's allowance for breakfast, it was utterly impossible for many men to go home and get their breakfast; and it did not even give them time to get a warm breakfast in the works. But the advantage is not, of course, all on the men's side, as, owing to being able to have a slight rest after the meal, the men are quite prepared and fit to start work immediately the bell rings.

THOMAS S. F. GIBSON.

SOUTH METROPOLITAN GAS COMPANY,
ROTHERHITHE STATION,
April 18, 1904.

I am greatly pleased to be in a position to testify as to the very great benefit that is derived, both by workmen and the Company, through the granting of an additional quarter-of-an-hour in the morning for breakfast. I am strongly of opinion that the result of this arrangement is that better time is kept, and the work is better done.

The men who remain upon the works during the breakfast time, do probably take the opportunity to look at the daily papers, and with regard to those men who go outside the works, I cannot but think that they spend the time in a legitimate manner, and do not go into the public houses to obtain drink.

W. D. HUNTER.

SOUTH METROPOLITAN GAS COMPANY,
EAST GREENWICH STATION,
April 19, 1904.

With reference to the subject of the extra time allowed for breakfast, I am of opinion that it is one of the most highly appreciated of the many acts of consideration shown by the Company to its employees. It is good for the men, as it gives them time to get their meal without undue haste, and permits of a short time for recreation before resuming work, and I am sure it is no loss to the Company, as the men work right on up to the time, and do not anticipate the knocking-off signal as was frequently the case under the old arrangement. Rather than go back to that, the men would prefer to work extra time at night, or have the dinner hour curtailed; and this is strong evidence of their appreciation.

I am glad to be able to say that the public houses are not visited by the men during the breakfast interval; and on this subject I would like to say, also, that my observation leads me to think that there is, speaking generally, a distinct improvement.

JOSEPH TYSOE.

SOUTH METROPOLITAN GAS COMPANY,
709, OLD KENT ROAD, S.E.,
April 21, 1904.

I should like to supplement the accompanying statements of the Engineers of the South Metropolitan Gas Company by expressing my firm conviction that they have not overstated the benefits to the men and to the Company arising from the change.

I can speak from my own personal knowledge as to the good effect at the Vauxhall and Bankside Works, of which I had charge, as well as at the Old Kent Road Works.

CHARLES CARPENTER.

CRYSTAL PALACE DISTRICT GAS COMPANY,
LOWER SYDENHAM,
April 16, 1904.

As the result of my own observation, and of inquiries I have made of the foreman and some of the officers and leading workmen, I am convinced that the extension of the breakfast interval from a half to three-quarters of an hour has proved an immense boon to the men and given them great satisfaction. Before the alteration was made, I had some doubts as to the necessity for the change; but I am quite satisfied now it has been beneficial, both to the men and to the Company.

Formerly, the men—most of whom live at some little distance from the works—had a rush to get home, snatch their meal, and get back to the works in the half-hour. They were, therefore, tempted to leave off work a few minutes before stopping time, and get as near to the gate as possible before the whistle blew. They do not do this now, and the foremen tell me they get to work after breakfast with greater alacrity than they were wont to do. In this way, and in the good feeling which the concession created, I am sure the Company is more than repaid for the slight reduction of the working time. I may add that since the alteration, very few, if any, of the men go to a public house at breakfast time.

SYDNEY Y. SHOUBRIDGE.

The Methven Screen.—Referring to the question relating to the Methven screen, which was discussed at the annual meeting of the London and Southern District Junior Gas Association in May (see "JOURNAL," May 31, p. 576), "Index," writing from New York, says: "In regard to the discussion of the proper point for the measurement of scale in use of the Methven screen, readers are referred to Professor Jacobus's paper on this point, which was published in the 'JOURNAL' under date of Jan. 7, 1896."

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bill read the second time: Hamilton Gas Order Confirmation Bill.

Bills reported: Doncaster Corporation Bill, North-Western Electricity and Power Gas Bill, Skipton Water and Improvement Bill.

Bills read the third time and passed: Brymbo Water Bill, Crystal Palace District Gas Bill, Oakengates, Dawley, and District Joint Water Board Bill, Southend-on-Sea Gas Bill.

Petitions have been presented by the Lea Bridge District Gas Company against the Leyton Urban District Council Bill; and by the Swindon United Gas Company against the Swindon Corporation Bill.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Gas Orders Confirmation Bills (Nos. 2 and 3), Manchester Corporation (General Powers) Bill, Oakengates, Dawley, and District Joint Water Board Bill.

Bills presented and read the first time, under the Private Legislation Procedure (Scotland) Act, 1899: Arbroath Corporation Water Order Confirmation Bill, Dunfermline District Water Order Confirmation Bill, and Melrose District Water Order Confirmation Bill.

Bills reported: Derwent Valley Water Board Bill [Lords], Ebbw Vale Urban District Water Bill [Lords], Filey Improvement Bill [Lords], Harrogate Water-Works Tramroad Bill [Lords], Rotherham Corporation Bill.

Lords Bills read the third time and passed: Matlock and District Gas Bill, Preston Corporation Water Bill, Shipley Urban District Council Bill, Ticehurst and District Water and Gas Bill.

GLEANINGS FROM THE COMMITTEE ROOMS.

BILLS dealing purely with gas and water are now rare things in the Committee rooms; but nevertheless, one way or the other, interest has been kept from flagging—mainly through the instrumentality of the Electric Lighting Orders, and the magnificent success which has been achieved in respect of the Bermondsey clause. The authorities are acknowledging that 14-candle gas has come greatly into favour; and it is not a matter of great difficulty now for promoters to get down to this point. The question of discounts for gas continue to crop up; promoters looking upon a heavy rebate as facilitating their resistance to electricity in the power business. The Barnet District Gas and Water Company are again to encounter a heavy opposition. Their Bill is in a group referred to a Committee now sitting; but its progress has been retarded by the time absorbed in the consideration of the Lancashire and Yorkshire Railway (Steam Vessels) Bill. Several matters of interest will be found in the succeeding paragraphs.

The Revised Bermondsey Clauses. Readers of the "JOURNAL" have had in their possession a week now the best that can be said for and against the principle of the Bermondsey clause in the report of the long discussion by Counsel before the Duke of Northumberland's Committee, in connection with several Electric Lighting Orders—viz., Maidenhead, Huddersfield, Hampton Wick, Malden and Coombe, Tamworth, Eastleigh, Hanwell, Watford, and Bath. In all cases, the Gas Companies concerned as ratepayers were the petitioners for the insertion of the clause (in certain instances one had been agreed); and the success which they scored completely justifies the advice that has been tendered in these columns from time to time to gas companies to continue pegging away at this on every opportunity. The Committee took a broad view of the duty which had been placed upon them. The question as they regarded it was properly and simply this: Is it, or is not, to the public advantage that the Bermondsey clause, or something like it, should be inserted in Orders of this description? No one can accuse the Committee of not having gone minutely into the matter; and their thoroughness is accentuated by the fact that they refrained from giving a decision until they had heard all that could be said by both sides on every Order, and by the Board of Trade in justification of their hostility to the imposition of the clause. Now that we have the views of the Board on the question, all that can be said of them is that their recital has revealed their weakness; and it did not greatly exercise that astute practitioner Sir Ralph Littler to go through the whole series of objections and point out their individual hollowness. The Committee's answer to the proposition they set before themselves is that it is in the public interest that something like the Bermondsey clause should be inserted in these Orders where it is asked for, or where it is agreed that such a clause should go in. Hitherto the precedents for and against the insertion of the clause have been about equally balanced; but the decision of this Committee turns the scale well over to the favourable side. This must have a far-reaching effect in the future; and while the Board of Trade may still argue that they have received "no decided instruction from Parliament," they cannot possibly ignore the verdict of such an inquiry as has been made into the matter by a Committee of such strength as that over which the Duke of Northumberland presided. The result is a victory over which gas companies may be pardoned for being elated; and it will assuredly make them persistent in the matter until Parliament sees fit to relieve Committees of a continuation of such inquiries

by making these or similar provisions part of the general law relating to municipal electric lighting ventures. The arguments for the provisions have been often set out in these pages; and readers who desire to fully master them cannot do better than read the whole of the discussion in Committee as published last Tuesday.

The Provisions. Early last week, the promoters brought up a set of clauses, and the Gas Companies an alternative set, to comply with the decision delivered by the Committee the previous week. In the end their Lordships adopted those of the promoters as the base of what was eventually agreed to. Those printed towards the end of our report are the ones as finally passed. It will be seen that they provide for the publication of a notification that the accounts of the undertaking have been issued, and that copies can be obtained at the price of 1s. Next, that the undertakers shall, on the expiration of the third complete financial year, after they have commenced to supply electrical energy, and on the expiration of each third succeeding year, reconsider, and if necessary revise and thereafter maintain, the scale of prices charged for electrical energy, so that, so far as is reasonably practicable, no rate will be required for the purpose of defraying the future expenses of the undertaking during the next three years, provided that the maximum prices under the Order are not exceeded, and that the scale of prices so reconsidered and revised may be from time to time reconsidered and revised by the undertakers. Another clause enables the undertakers to enter into contracts beyond the periods at which revision may take place. This contract clause, however, is not to be applicable to ordinary consumers; and the price charged under each contract is to be subject either to revision at the next triennial revision, or varied in the same proportion as the price charged to ordinary consumers. Then the clause as to the charge for street lighting and other municipal purposes appearing in the Marylebone Order has been included where agreed or asked for. This ensures that there shall not be made against the borough rate, in respect of street lighting or other municipal purposes, a charge at a higher rate than that charged to consumers using energy for similar purposes and for the like hours of supply. It will be seen that the clauses are drawn so as not to prevent a more frequent revision—say, annually or biennially if preferred. It will be remembered that the Huddersfield Corporation had agreed with the Longwood Gas Company upon a form of clause for insertion in the Huddersfield Order. One of the clauses of the agreement has been adopted by the Committee, in addition to the general clauses already referred to. It is as follows: "Subject to the provisions of this Order, the charges for the supply of energy for lighting purposes in the urban district of Golcar under the provisions of this Order shall be at least 10 per cent. in excess of the charges for the supply of energy for similar purposes for the time being in the borough of Huddersfield."

Lower Candle Gas for Leeds. On Tuesday and Wednesday, the Leeds Corporation (Consolidation) Bill was before the Police and Sanitary Regulations Committee. This Bill contains both gas and water clauses. The latter were opposed, but not the former. In regard to gas, the Corporation asked to be allowed a reduction of 2 candles in the illuminating power; and, in view of this, they are lowering the statutory maximum price to 3s. 6d.—that is a drop of 3d. The Local Government Board appear to have resigned themselves completely to 14-candle gas; it being remarked by Mr. Boyce, who represents the Board, that gas suppliers "are reducing to 14 candles in all these Bills now." And the Chairman remarked to Mr. Jeeves (who was appearing with Mr. Ram, K.C., Mr. Honoratus Lloyd, K.C., and Mr. Simpson): "You can have your 14-candle power." But, as a matter of fact, the Corporation will not—at all events for some time—go below 16 candles in practice. Another clause proposes to permit the Corporation to allow a rebate of 20 per cent. to large consumers of gas, and 5 per cent. for prompt payment. The charge at Leeds is a uniform one of 2s. 3d., subject to a discount of 5 per cent. There is no rebate to large consumers; but the Gas Committee, in the face of the competition with electricity for power purposes (a discount being allowed in the case of the latter), feel they must follow suit. There was some debate over the 20 per cent. and what was meant by "large quantities." This was defined as meaning above a million cubic feet per annum. The clause was allowed.

The Water Clauses. Over the water clauses, there was much discussion; the Bradford Corporation and the Wetherby Water Company feeling themselves aggrieved by them. The former alleged that the Leeds Corporation were proposing to take in an area in excess of that in which they are now supplying, because they seek to include Esholt, Hawksworth, and Baildon. The contention of the promoters, however, was that this is a mistake, because the limits of the Corporation as defined by the Act of 1847 embrace Otley; and the places mentioned were all then in that parish. Since that date, however, they have been made into separate parishes; so that really no excess of supply area is asked for. Bradford claimed that they could more economically supply some of these outside districts than Leeds. They also asserted that their rights and privileges in respect of the River Wharfe were endangered by the Bill. The promoters' proposal is to abandon their powers to take water from the Wharfe; and, in lieu thereof, to take a similar quantity of water from one of the tributaries—the Washburn. Bradford also urged that Leeds should not be allowed to supply in any part of the area over which they have rights. Here Bradford was referring to Calverley, Pudsey, and Farsley, over which they have the right, but not the obligation, to supply. Bradford, through Mr. Balfour Browne, made a strong appeal to the Committee not to grant anything to Leeds in respect of the supply of the outside districts as against Bradford. The discussion over these matters was carried on with much vigour; and in it the Wetherby Water Company joined, being represented by Mr. Wedderburn, K.C. In the end, Leeds obtained all they asked, with this exception—Baildon having its own water supply, and it being admitted that Leeds cannot by gravitation supply the township, and it not being suggested that there was any obligation on Baildon to take Leeds water, or any desire on the part of Leeds to supply Baildon by pumping, the Committee thought it desirable to take Baildon out of the limits of supply. With regard to the Wharfe, the rights of Bradford were saved. Leeds will, as they desire, have the power to take all the waters of the Washburn, subject to an obligation to turn 4 million gallons daily into the River Wharfe from the Washburn, and Leeds will give up any power to pump from the Wharfe. Other clauses dealt with the question of charges for domestic supplies. Hitherto the charge has been made on the gross rental; but the Local Government Board has said it should be made on the gross estimated rental as appearing in the poor rate valuation lists. This has now been accepted. The question of the charges in the outside districts was raised; and the Committee inserted a provision that in no case shall the amount charged be more than 10 per cent. in excess of the maximum. There are two other points about the Bill which are of general interest. In another clause, the Corporation asked that, when a man let premises in tenements, he should be made liable for the water-rate, which meant in effect that it was to be paid to the Corporation through the landlord, who would have to collect it in the rent. While the Committee had considerable sympathy with the object in view, they held that they were bound by the general principle upon which they invariably act, not to alter the general law without proof of special circumstances applicable to the particular place. It may be a good alteration of the law; but they did not feel justified in applying it solely to Leeds. A further clause relating to regulations for the prevention of waste was discussed. This was allowed in the model form, but without power to refuse fittings unless they had been stamped by the Corporation.

Matlock and Power Gas. A fortnight since the position in connection with the Matlock and District Gas Company's Bill was very fully explained. The provisions of the measure are quite interesting in the modernness of their scope and character. The Bill as then stated contains a power gas clause; and in their report to the House, Sir Aubrey Fletcher's Committee specially alluded to this. It is an important success; the clause having been carried through both Houses, though contested. The report says: "The Committee were fully informed as to the proposals of the promoters in regard to the supply of power gas, and found that all necessary provisions had been inserted in the Bill during its passage through the House of Lords, as to the obligations and conditions under which such supply is to be furnished by the promoters, and had themselves added a stipulation as to price." Farther on in the report, it is remarked: "The standard price had been reduced, the prescribed illuminating power of coal gas had been fixed at 15 candles, and the special rate chargeable within the new area of supply had been limited to one parish. The Committee were satisfied that it was not advisable to fix by the Bill the price of power gas." The stipulations as to the price referred to above were set forth in "Gleanings" for June 21.

Bognor Gas. The Bognor Gas Company, by the aid of Mr. Balfour Browne, Mr. Paddon, and Mr. Joseph Cash (as reported in the "JOURNAL" last week), showed the strongest reasons to Earl Dartrey and other members of the Upper House why the Bill containing the Provisional Order which they promoted should be confirmed without any alteration of the powers contained in it. In the first place, the Company are subjected to the Bognor coal dues of 2s. per ton; and these dues are almost alone sufficient for them to desire to remove their works (as the Hastings and St. Leonards Gas Company have done) beyond the reach of the burden. That is one of the objects of the Order—the obtaining of authority to use for gas manufacture a new site of some 6 acres (near the railway) purchased last year. The proximity of the new works to the railway will bring about a saving of 9d. per ton, in addition to the relief from the dues. Very naturally, the Local Authority cannot see that there is any necessity for the removal of the works; and they are of opinion that it will be a bad thing for the consumers. The consumers may see the matter in another light; inasmuch as they will benefit in all the economies the Company can effect—and these savings of coal dues and carriage are highly important ones. The Local Authority asked for the insertion of a purchase clause; but they met with no more success than on the other matters. The Board of Trade had reduced the capital of £35,000 asked for to £20,000. The Bill went through with flying colours.

The Cost of Vexatious Opposition. Just recently the Sunderland Corporation have learned that those hostile to a Bill cannot play at opposition without running the risk of being fined for their foolery. The Corporation entered an opposition to the Rural District Lighting Bill, stating that they objected to an outside authority coming into the district because they themselves intended to incorporate the places referred to. This hint as to incorporation was keenly resented by all the rural authorities concerned; and they worked in support of the Bill. The promoters and their supporters prepared for the fray, even to the briefing of Counsel. The Bill went along as an opposed measure until it came before the Select Committee of the Lords to whom it had been referred, when, to the astonishment of the promoters and the annoyance of their Lordships, no opponents appeared. The Chairman of the Committee thereupon censured the Corporation, and very properly mulcted them in costs. Now the Corporation Electricity and Lighting Committee are furious over the matter; and it is said they are going to refuse to pay the money, which is stated to amount to about £500. It is also reported that the Agents of the Corporation hold that the Parliamentary Committee have exceeded their rights in the matter. We shall see. At all events, there has been some bungling over the matter, for which the Corporation, or someone connected with it, are entirely responsible; and there is bound to be more heard of this in the Council Chamber. Meanwhile, frivolous or careless objectors should take warning.

Electricity Bill. There was a short sitting last Thursday—not lasting more than an hour and a half—of the Select Committee appointed by the Lords to consider the Electricity Bill promoted by the Board of Trade. The Department desire to have authority to grant Provisional Orders to promoters to take land compulsorily for the purposes of electricity generating stations, to supply electricity in bulk, and to enable two or more local authorities to combine for these purposes. It follows, as the Board are asking for these powers, they are helpless in these respects at present. The proceedings on Thursday were of a somewhat formal character; their Lordships spending some of the time in privately discussing procedure.

They appear to be desirous of limiting, as far as possible, the appearance of Counsel before them; but they decided to hear by Counsel the County Councils Association, the Municipal Corporations Association, and the London County Council. These will lead off. The London Gas Companies have petitioned against the measure. The Chairman of the Committee holds out hopes that they will be allowed to appear by Counsel; but he has not definitely said so yet. It does not look as though the Committee have any intention of sitting continuously. They start to-day with the cases of the Associations mentioned above; and will meet again on Thursday. The Gas Companies are not likely, under these circumstances, to get a hearing just yet.

Rotherham Candle Power, Loans, &c.

The Omnibus Bill of the Rotherham Corporation contains certain clauses relating to gas and water; and it has been before the Police and Sanitary Regulations Committee of the Commons. One of the principal changes sought is the lowering of the illuminating power of the gas from 16 to 14 candles; and Professor Vivian B. Lewes was brought to bear on this matter. The lately much-favoured idea of promoters, of obtaining authority to allow a discount of 10 per cent. for prompt payment, and 15 per cent. in connection with special contracts with large consumers, also has part in the Bill. The clauses referring to these matters were passed. One, however, was struck out which proposed to empower the Local Government Board, if they thought fit, to sanction applications for loans to provide working capital for the gas undertaking, to be repaid in 25 years. It was explained to the Committee by the promoters that the lack of these powers has caused them to run up an overdraft of from £10,000 to £12,000 at the bank; and the Corporation now desire to get rid of the overdraft and obtain a loan for providing working capital. They also assert that the Local Government Board meet their applications for loans with the statement that they cannot grant more than ten years for repayment. The explanation was given to the Committee that the overdraft arose to a great extent because the money received from the consumers was always four months in arrear, and because the Corporation have a large stock of gas stoves and fires which they let out on hire, a considerable portion of which has been purchased out of revenue. As said, the clause was struck out, as the Local Government Board have already the power to grant all that the clause seeks; but the Board think that ten years is a sufficient time for the repayment of the loan. One other matter. A clause was granted for enabling the Corporation to increase the charges for water supply, so as to meet any deficit occasioned by the heavy expenditure incurred in connection with the Derwent water scheme, in which Rotherham is one of the participants.

A Question of Repayment.

The period of repayment of the Doncaster water-works loans has been discussed before the Duke of Northumberland's Committee, with good effect so far as the pockets of the present ratepayers are concerned. In the Bill, the Corporation desire to have the period extended to 60 years within which they are to repay the money borrowed for expenditure on their Thrybergh water-works. The Corporation, it will be remembered, joined with Sheffield and Rotherham in the great Langsett scheme; and when the sinking fund payment in connection with it becomes due, the burden on the ratepayers will be heavy indeed. From the first year after that payment has to be made, the loss will be about £12,000 per annum, which means a rate of 1s. 8d. in the pound. In the case of the Langsett scheme, 60 years was allowed for repayment; and an extension of the period for repayment in respect of the Thrybergh works from 45 years to 60 years would reduce the rate from 1s. 8d. to 1s. 4d. in the pound. As the burden of new works is being largely undertaken for the benefit of future generations, this is considered quite fair. The Lower House agreed to the proposal; but, when the Bill entered the Lords, the Lord Chairman thought the original period of 45 years should be adhered to—his opinion being that because Doncaster were doing so favourably out of their other undertakings, they could well bear a loss of £12,000 on the water undertaking. His philosophy is not sound on this point. Even Mr. Balfour Browne, fresh from his onslaught on the Bermondsey clause, was heard telling the Duke of Northumberland (the Chairman of the Committee who had been considering the question of the clause) that "each undertaking ought to stand alone, and that the fact that some of the undertakings of the Corporation were carried on at a profit was no reason why the water concern should be conducted at a loss." The Duke and his colleagues agreed with this dictum of the learned Counsel; and they allowed the sixty years.

HOUSE OF LORDS COMMITTEE.

Tuesday, June 28.

(*Before the Duke of* NORTHUMBERLAND, *the Duke of* WELLINGTON, *Lord* EMLY, *Lord* TENTERDEN, *and Lord* CRANWORTH.)

THE "BERMONDSEY CLAUSE" IN ELECTRIC LIGHTING PROVISIONAL ORDERS.

The Settlement of Clauses.

Mr. VESEY KNOX, on behalf of the promoters of the Maidenhead Order, said he thought the more convenient course would be to go through the provisions of the clause he proposed to carry out the decision of the Committee, and then refer shortly to the points of difference between that clause and the one proposed on behalf of the Gas Companies. The first sub-section of the clause provided for the publication of the accounts of the undertaking and was as follows:—

(1) The undertakers shall, so soon as the annual statement of accounts of the undertakings under this Order and under the Maidenhead Electric Lighting Order, 1898, has been filled up in the form prescribed by the Board of Trade under the Electric Lighting Act, 1882, publish in a newspaper circulating in the borough a notification that such statement of accounts has been filled up and that copies of it can be obtained at the offices of the undertakers at a price not exceeding 1s. a copy, and such publication shall be in addition to, and not in substitution for, any publication prescribed by the Board of Trade under the Electric Lighting Act, 1882.

The Gas Companies clause sought to force upon the Corporation the publication of the whole statement of accounts in a local newspaper. But the Corporation held that if they provided for publication in such a way that anyone who was really concerned could easily obtain a copy, this would accord with the decision of the Committee. The second sub-section was:

(2) The undertakers shall, on the expiration of the third complete financial year after they have commenced to supply electrical energy under this Order and on the expiration of each third succeeding year, reconsider, and if necessary revise, so far as is reasonably practicable, the scales of prices charged for electrical energy under this Order and under the Maidenhead Electric Lighting Order, 1898, respectively, so that in the judgment of the undertakers no rate will be required for the purpose of defraying the future expenses of the said undertakings during the next three years: Provided nevertheless that (*a*) the prices to be charged shall not exceed the maximum prices which may be charged under this Order and the Maidenhead Electric Lighting Order, 1898, respectively; (*b*) the scales of prices so reconsidered and revised may be from time to time in like manner reconsidered and revised by the undertakers.

There were a number of differences between what the Gas Companies suggested and what he proposed. This provision, he hoped, did apply the decision of the Committee. The third sub-section of the clause was as follows:

(3) Nothing in this section contained shall prevent the undertakers from entering into contracts for periods which may extend beyond the periods at which any revision may take place under the provisions of this section on special terms under special circumstances not applicable to ordinary consumers, but, save with the consent of the Board of Trade, each such contract shall provide that the price to be charged for energy supplied under such contract shall either (*a*) be subject to revision at the next revision provided for in this section, or (*b*) vary in the same proportion as the prices charged to ordinary consumers. Provided that the undertakers shall not without their consent be required to accept any price lower than the minimum price mentioned in such contract.

With very slight exceptions, this was in accordance with the decision of the Committee, and also with what the Gas Companies asked for. There was one provision, however, which, to be perfectly frank, he should tell them was going beyond the decision. He referred to the words, "Save with the consent of the Board of Trade." There might be special cases, in which a contract could not be entered upon, and would therefore be lost, unless the Corporation were able to contract for a long period. Such a case might occur with regard to the supply of energy to a tramway undertaking. Another case in which a long contract might be required was that of the erection of a new hotel.

The CHAIRMAN said, as far as he could see, what Counsel said with regard to a hotel would apply to every great undertaking which was going to consume a large amount of energy.

Mr. PADDON said his clients could not subscribe to the clause brought up by the promoters. Although in a colourless way it reflected the principles of the decision, it did not give practical effect to the decision; and it omitted very many essential qualifications. Mr. Vesey Knox was afraid of the trifling expense of publishing the accounts once a year; but by means of such publication every ratepayer would have the opportunity of becoming cognizant of the operations of the undertakers. If, however, the proposal of the promoters were adopted, a notification would appear saying simply that the accounts were ready; and it would be left to the ratepayers to buy them if they thought fit.

The CHAIRMAN: Is this provision made in any other case you can quote?

Mr. PADDON: In so far as it is not adapted to the decision of your Grace, I think it embodies the spirit of the Electric Lighting Act of 1882.

The CHAIRMAN: The Electric Lighting Act does not enforce publication in a newspaper.

Mr. PADDON: "Shall be published in such manner as shall from time to time be prescribed in that behalf by the Board of Trade." That is the Act; we have varied it having regard to the requirements. The clause which I propose to meet the decision of the Committee is as follows:—

(1) Within one month of the date on which the undertakers shall make up their annual statement of accounts in pursuance of section 9 of the Electric Lighting Act, 1882, they shall, in each and every year, publish such statement of accounts in the same form as the same shall be made up as aforesaid by inserting such accounts in each of two successive weeks in a local newspaper circulating in the district.

In case the undertakers make default in complying with the provisions of this sub-section, they shall be liable to a penalty not exceeding forty shillings for each day during which such default continues.

(2) The undertakers shall, at the expiration of the period of three years from the date of the passing of the Act confirming this Order, and thereafter at the expiration of every further period of three years, revise, fix, and thereafter maintain, the prices to be charged for energy to be supplied by them for the then ensuing three years (but not exceeding the maximum prices specified in this Order) so that, as far as reasonably practicable, there shall be no deficiency of income to be charged upon, or paid out of, the local rate as defined in the schedule to the Electric Lighting Act, 1882, and so that the annual revenue of the undertaking shall not be less than the annual expenditure (which expression shall, for the purposes of this section, include charges on revenue account and charges for interest on moneys borrowed and instalments of principal and sinking fund); and in estimating the expenditure for any such period after the first revision of prices under this section, the undertakers shall take into account and provide for any deficiency of income in any former period of three years.

(3) In every year after the expiration of one year from the date of the first revision of prices under sub-section 2 of this section, the Auditor prescribed by the Electric Lighting Acts, 1882 and 1888, in respect of the undertaking shall, within fourteen days of the completion of the audit in such year of the accounts of the undertaking, report to the Board of Trade whether the undertaking had during the year to which such audit relates been carried on so that there was no deficiency of income for such year to be charged or chargeable upon the local rates as hereinbefore defined, and whether the prices current at the date of such audit are sufficient to make the annual revenue of the undertaking equal to the annual expenditure; and if such Auditor report that such current prices are not sufficient for such purpose,

the Board of Trade shall forthwith fix the prices to be charged by the undertakers for energy to be supplied by them during the remainder of the then current period of three years so that so far as reasonably practicable the annual revenue of the undertaking shall be not less than the annual expenditure.

(4) Nothing in this section shall prevent the undertakers from entering into contracts for periods extending beyond the periods at which any revision may take place under the provisions of this section on special terms under special circumstances not applicable to ordinary consumers, but each such contract shall provide that the price to be charged for energy supplied under such contract shall either (*a*) be subject to revision at the periods of revision provided for in this section, or (*b*) vary *pari passu* with any variation of prices charged to ordinary consumers made during the existence of such contract. Provided that the undertakers shall not without their consent be required to accept any price lower than the minimum price mentioned in such contract.

(5) Subject to the provisions of this section, the undertakers may, if they think fit, at the end of each year revise the prices (other than prices fixed by the Board of Trade) to be charged for energy to be supplied by them.

(6) There shall not be made against the district rate or any other rate for energy used by the undertakers for street lighting or any other purpose a charge at a higher price than that charged to consumers using energy for similar purposes and for the like hours of supply.

He was at grave issue with sub-section (2) of the promoters' clause, because there was an omission from it which was made good by the concluding lines of his second sub-section. Those last words were essential to give any significance or force to the decision of the Committee. The third sub-section simply provided machinery to ensure that the preceding sub-section should be carried out. With regard to contracts, he suggested that many of the arguments of Mr. Vesey Knox had no true basis. Sub-section (4) of his (Mr. Paddon's) clause seemed to carry out the recommendations of the Committee in regard to this matter. Sub-section (5) merely related to more frequent revisions than those allowed under the clause; and without sub-section (6) he did not think there would be the slightest chance of the clause operating successfully. He asked for the clause he had brought up as more complete, more practicable, and better designed to carry out the decision than the clause of the promoters.

Mr. Vesey Knox, in reply, said the last sub-section of Mr. Paddon's clause was not asked for by Mr. Paddon's clients; it had not been argued or cross-examined upon; and it had only been proposed because in certain other specific cases where it was asked for the Committee said it should be inserted. In Maidenhead, moreover, it would have no real bearing upon the undertaking. He objected to the proposal to publish the accounts in full. The decision on the point was that the accounts should be published in such manner as might be prescribed by the Board of Trade. There had been no method prescribed by that body; but the promoters' clause would save the power to the Board of Trade. So that if the Board came to the conclusion that a portion of the accounts should be published in a newspaper, it would be in their power so to prescribe. If the whole of the accounts were published every year, in the case of Maidenhead the cost would be about £20 or £25—rather more than a month's coal bill. The Board of Trade might, if they thought fit, prescribe a short abstract for publication, but he knew of no case where the whole accounts were published. In the second sub-section of the clause proposed by the Gas Company, they had gone beyond the decision of the Committee. They said: "The undertakers shall at the expiration of the period of three years from the date of the passing of the Act," whereas the Committee had decided that it should be three years from the supply of energy. The working of a clause like this must be subject to a good deal of difficulty; and they respectfully asked that it should be so framed as to carry out the decision, which was that the rates should be revised so that no loss should be incurred by the ratepayers on the undertaking. Sub-section 3 of the Gas Companies' clause was impracticable, because it was impossible to fix the rates so that there could not be a loss. In section 4 of the proposed clause, the Gas Companies used the words *pari passu;* but the promoters had thought that the words "vary in the same proportion" would meet the matter better. The meaning that might be attached to *pari passu* was uncertain, and they asked that the words should be "in the same proportion;" so that if the prices were increased to the ordinary consumer one-fifth, the prices to the special consumer should be increased one-fifth too. The Gas Companies' clause would only allow revision to take place at the end of the year; but in competition with the Gas Companies there might be cause to reduce the price during the course of the year. He respectfully submitted that the clause the promoters had submitted carried out the more accurately the decision of the Committee.

Mr. Pelham, representing the Board of Trade, said he did not wish to express any opinion as to the merits of the clause generally, but only so far as duties are proposed to be imposed on the Board of Trade by this clause. These duties are put upon the Auditor. With that the Board of Trade have nothing to do; they only appoint auditors in the case of companies. In the case of local authorities, they are either corporation auditors, or they are district auditors appointed by the Local Government Board. Sub-section 3 of the proposed clause of the Gas Companies seems to make the revision annual instead of triennial. The Board of Trade are not interested in this; but they do object very strongly indeed to the duty being imposed upon them. They have no staff for the purpose. It will be necessary to hold a local inquiry into all the circumstances of the cases, and it would be a very expensive and troublesome duty, which the Board would be quite unable to undertake. It would not only affect electric lighting, but would form a most dangerous precedent for other things. The Board of Trade have never been called upon to fix actual prices. They fix maximum prices sometimes on their own authority, and sometimes subject to the revision of Parliament. It is quite impossible that the Board should know all the exigencies of local trade. It would be a very complicated inquiry and duty; and I am authorized to say that it would be quite impossible for the Board to undertake it. The only remark I have to make as to the other clause submitted by the promoters, is that there the Board also object to the duty imposed on them as to contracts. It might not be so objectionable if it were limited to statutory undertakings like tramways; but if the Board have to go into the question of contracts for an hotel in some town in Lancashire or Yorkshire, they may be called upon to decide contracts for every cotton mill or other place of business. This is a duty which they do not think they can possibly undertake with advantage.

Mr. Paddon said the Gas Companies were willing to abide by the decision of any arbitrator appointed by the Board of Trade. This would relieve the Board of any duty or burden.

A clause similar to the Maidenhead clause was brought up for the Hampton Wick Order.

The Chairman said that, as a basis, the Committee would take the clause submitted by the promoters.

Mr. Wedderburn asked how many people would read the accounts of the electric light undertaking if published in the newspaper. On the other hand, all people who had applied their minds to the matter would be willing to pay a shilling. To say that all the accounts must be published in a newspaper would be to put an unnecessary expense on the undertaking.

The Chairman said in regard to the words "in the judgment of the undertakers," it seemed that they made the whole clause nugatory.

Mr. Hutchinson, for the Malden Gas Company, objected to the clause of the promoters. If the cost of publishing the accounts was to be borne by the whole of the ratepayers, where did the injustice lie? To merely issue a notification buried in the columns of a newspaper, that the accounts could be seen on the payment of a shilling, would discourage the great body of the ratepayers from taking an interest in the matter. He asked the Committee to say that the accounts should be published *in extenso*. The decision of the Committee had been that the authority should triennially revise the rates so that no loss might be incurred by the ratepayers; but the promoters' clause did not carry out this decision. In regard to the words "future expenses," with reference to the period at the expiration of each succeeding three years, supposing in one period a loss occurred, and the judgment of the undertakers had not been sufficiently well directed in fixing the prices, how did the clause of the promoters meet it? The clause would not meet it at all, it simply devoted itself to the payment of future expenses, and utterly neglected to provide for past losses. In regard to section 3, the argument had been put forward that the position of tramway undertakers would be affected; but he differed from his learned friend as to the effect of the clause. The Committee had decided that contract prices were to vary *pari passu*. As he understood the decision, it was that, supposing the prices for the general supply of electricity should be reduced by 20 per cent., then contract prices should be reduced by 20 per cent. also, not that if the general price were reduced ½d. the contract price should be reduced ½d. He asked the Committee to strike out the words "save with the consent of the Board of Trade," and to accept the clause put forward by the Gas Companies—by the ratepayers—and not that of the promoters.

Mr. Wedderburn, in supporting in arguments in favour of the clause put forward by the promoters, said section 3 in both clauses was identical, with the exception that the words "in the same proportion" were inserted in the one case and "*pari passu*" in the other. The whole point was whether there was to be in their special case an opportunity for the local authority to go to some unprejudiced tribunal and say, "This is a peculiar case, and unless we can make a contract for more than three years we shall lose the contract; and we therefore ask to be allowed to go beyond the three years." He submitted that there ought to be such an opportunity, as the Committee could not have meant to exclude anything necessary to the success of an undertaking. In regard to the words "in the judgment of the undertakers," he would be content to take them out if the Committee would insert words to make it clear that the duty on the local authority was honestly and to the best of their ability to reconsider and make the estimate of prices, and not to be infallible in regard to them. Then there was the point whether, where there was a deficit at the end of three years, it should be carried on or a rate made. The fair thing was that they should, having done their very best in the preceding period, at the beginning of each succeeding period start free. Otherwise it would be found, as perhaps the Gas Companies would desire, that the undertaking would be saddled with an increasing burden which would render it more and more difficult to make the accounts balance.

Mr. Blenerhassett submitted, on behalf of the Bath Urban District Council, that the section of the clause dealing with public lighting should not be inserted in their Order. In their case, the matter had not been raised at all; the opposition being confined entirely to the insertion of the "Bermondsey Clause."

Mr. Thesiger, for the Bath Gas Company, argued that the section was necessary to the "Bermondsey Clause," because, without it, the Local Authority could make the clause nugatory by charging themselves with a higher rate in regard to public lighting.

The Committee decided not to insert the public lighting section in the Bath Order.

After hearing Counsel on the remaining Orders, the Committee deliberated; and on the re-admission of the public,

The Chairman said the Committee adopted the clause brought up by the promoters with the following alterations: In the second section, line 4, after "and if necessary revise, so far as is reasonably practicable," insert "and thereafter maintain." In line 7 of the same section, leave out the words "in the judgment of the undertakers." In section 3, line 5, leave out the words "save with the consent of the Board of Trade," and in proviso (*a*) "be subject to revision at the next revision provided for in this section," after "next" insert "triennial." The decision would apply only to the Orders where the clause had been asked for.

The Committee, after hearing Counsel, decided not to insert the lighting clause in the Hanwell Order.

Wednesday—June 29.

On the resumption of the proceedings to-day,

The following clause was submitted as carrying out the decision of the Committee. It was explained by the Parliamentary Agent for the Maidenhead Order that the arrangement of the words in section (2) had been slightly altered. The clause runs—

(1) The undertakers shall, so soon as the annual statement of accounts of the undertakings under this Order and under the Maidenhead Electric

Lighting Order, 1898, has been filled up in the form prescribed by the Board of Trade under the Electric Lighting Act, 1882, publish in a newspaper circulating in the borough a notification that such statement of accounts has been filled up, and that copies of it can be obtained at the offices of the undertakers at a price not exceeding one shilling a copy, and such publication shall be in addition to, and not in substitution for, any publication prescribed by the Board of Trade under the Electric Lighting Act, 1882.

(2) The undertakers shall, on the expiration of the third complete financial year after they have commenced to supply electrical energy under this Order, and on the expiration of each third succeeding year, reconsider, and, if necessary, revise and thereafter maintain, the scales of prices charged for electrical energy under this Order and under the Maidenhead Electric Lighting Order, 1898, respectively, so that, so far as is reasonably practicable, no rate will be required for the purpose of defraying the future expenses of the said undertakings during the next three years: Provided nevertheless that: (*a*) the prices to be charged shall not exceed the maximum prices which may be charged under this Order and the Maidenhead Electric Lighting Order, 1898, respectively; (*b*) the scales of prices so re-considered and revised may be from time to time in like manner reconsidered and revised by the undertakers.

(3) Nothing in this section contained shall prevent the undertakers from entering into contracts for periods which may extend beyond the periods at which any revision may take place under the provisions of this section on special terms under special circumstances not applicable to ordinary consumers, but each such contract shall provide that the price to be charged for energy supplied under such contract shall either: (*a*) be subject to revision at the next triennial revision provided for in this section, or (*b*) vary in the same proportion as the prices charged to ordinary consumers. Provided that the undertakers shall not, without their consent, be required to accept any price lower than the minimum price mentioned in such contract.

This was accepted by the Committee, and inserted, with the necessary verbal alterations, in the various Orders. The provision as to street lighting was also added in these Orders where it had been asked for, or where its insertion had been agreed to. It is as follows:

There shall not be made against the borough rate in respect of street lighting or other municipal purposes for which energy shall be employed a charge at any higher rate than that charged to consumers using energy for similar purposes and for the like hours of supply.

Subject to the provisions of this Order, the charges for the supply of energy for lighting purposes in the urban district of Golcar under the provisions of this Order shall be at least 10 per cent. in excess of the charges for the supply of energy for similar purposes for the time being in the borough of Huddersfield.

The remaining clauses having been adjusted, the Bills passed the Committee with respect to the opposed Orders contained in them; and were ordered for report to the House.

LONDON GAS COMPANIES AND THE SUPPLY OF ELECTRICITY BILL.

The Select Committee of the House of Lords to whom the above-named Bill has been referred met on Thursday, under the presidency of Lord Wolverton. As mentioned in our "Parliamentary Intelligence" last week, the three Metropolitan Gas Companies have petitioned against the Bill. The proceedings on Thursday were, to an extent, of a preliminary character. The Hon. T. H. W. Pelham, one of the Assistant-Secretaries to the Board of Trade, was in attendance, and stated that the Bill was the same as the one introduced into the House of Lords last year at the instance of the Board. It was intended to confer powers on the Department to grant Provisional Orders to promoters to enable them to acquire land compulsorily for the purpose of electric generating stations. At the present time the Board could not authorize local authorities to do this or to supply electric energy in bulk or combine with others to act jointly in generating electricity. The Bill would remedy many practical difficulties in the way of authorizing electricity undertakings. The objections to the measure came chiefly from local authorities; and he was of opinion that these could be met. Generally speaking, the Bill carried out the conclusions of the Joint Committee who, a few years ago, considered the question of the supply of electrical energy. It was not proposed by the Bill to authorize local authorities to supply electricity in bulk to outside public bodies, but it did give them power to sanction the buying up of entire undertakings by securing the consent of other authorities. He then went through the various clauses of the Bill, offering short explanations of them as he proceeded. The Committee then deliberated in private as to their procedure. On the public being readmitted, the Chairman said the Committee had decided that they would hear the County Councils Association, the Municipal Corporations Association, and the London County Council through Counsel. They would keep an open mind in regard to any important proposition made to them by any other bodies; but they were desirous of limiting in every possible way the number of Counsel appearing before them. The Committee would adjourn till Tuesday, and sit again on Thursday. Mr. Browne (of Messrs. Dyson and Co), on behalf of the Gas Companies, asked if their Lordships would allow them to be represented by Counsel. The Chairman said the Committee had not had time to deal with the petitions; but they thought that the Companies could go in. Mr. Browne said they felt it rather a hardship, and that they would be labouring under great disadvantages if they were to be left out, and the electricity undertakings only privileged to be represented before the Committee. The Chairman said he thought the Committee would hear Counsel on behalf of the Companies. The County Councils Association will be heard first at the next sitting of the Committee.

Suicide by Coal Gas.—Mr. David Henderson, honorary director of the Elim and Olivet Orphanage, Ballygowa, County Down, in connection with which a prosecution at the instance of the National Society for the Prevention of Cruelty to Children was listed for hearing at the local Petty Sessions, was recently found dead in bed at his Belfast residence. Mr. Henderson was discovered lying on the mattress, which he had evidently placed beside a gas-stove, the taps of which were fully turned on. These facts point to the case being one of suicide.

HOUSE OF LORDS COMMITTEE.

Friday, June 10.

(*Before the Earl of* DARTREY, *Chairman, the Marquis of* EXETER, *Earl of* DARTMOUTH, *Lord* DIGBY, *and the Marquis of* WINCHESTER.)

OAKENGATES, DAWLEY, AND DISTRICT JOINT WATER BOARD BILL.

The object of this Bill was to constitute and incorporate a Joint Water Board, consisting of representatives of certain Urban District Councils in the county of Salop; to repeal certain provisions of the Wellington (Salop) Water-Works Act, 1860; to transfer to, and vest in, such Board certain portions of the water undertaking of the Wellington District Council; and for other purposes.

Mr. A. J. RAM, K.C., and Mr. R. S. CLEASE appeared for the promoters. The petitioners in opposition were represented as follows: Wolverhampton Corporation, by Mr. CLAUDE BAGGALLAY, K.C., and Mr. W. J. JEEVES; Wellington (Salop) Urban District Council, by Mr. C. C. HUTCHINSON; the Duke of Sutherland, by Mr. LEWIS COWARD, K.C., and Mr. H. W. W. WILBERFORCE.

Mr. CLEASE, in opening in the absence of Mr. Ram, said the proposed limits of supply were the urban district of Oakengates, the urban district of Dawley, a portion of the parish of Hadley, and a portion of the parish of Wellington rural. The promoters of the Bill were the Oakengates Council, though to a certain extent Dawley might be regarded as acting with them. All the sanitary authorities whose districts were concerned had passed resolutions in favour of the Bill. The necessity for a water supply in the district was overwhelming. The local authorities during the past ten or fifteen years had done everything within their power to develop local sources, but without avail. The County Council had taken the most strenuous action with a view to establishing a water supply; and the Local Government Board had been appealed to on the subject, but with no satisfactory result. The present supplies consisted, generally speaking, of wells, more or less polluted. A portion of the area in Oakengates and Donnington Wood used water provided by the Littleshall Coal and Iron Company. With this exception, the district had to depend entirely on wells and pools, supplemented in some cases by rain water. In 1903, the County Council called a conference of local authorities in the district who required a water supply; and a Joint Committee of the various authorities was constituted, the outcome of whose deliberations was the present Bill. Donnington Wood ward to the north-east was in rather a peculiar position. There being no springs in the locality, the population was entirely dependent on pit water. Hadley and Wellington Rural were within the limits of supply of the Wellington Urban District Council. With the exception, however, of a few houses in one street, the Council had done nothing to supply the area outside their own district. The rural parish and Hadley had attempted to get water from the Urban District Council; but until the last month or two, they had stated that they must have the 10 per cent. guarantee before they would lay their mains into the parish. He admitted that the Wellington Urban District Council were justified in refusing the supply, because they had barely sufficient water for their own district. In September, 1900, the Local Government Board held an inquiry into an application by the Urban District Council for power to raise a loan of £4000 to enable them to supply Hadley and Wellington rural with water; but though the Local Government Department gave their consent to the loan, it was not until March of the present year that any attempt was made to take advantage of it. A Bill had been brought in to give a water supply; but it had been thrown out on the case of the promoters. Subsequently the Urban District Council had been prepared to sell to this Company their powers to supply water to Hadley and Wellington rural for £200. The learned Counsel then described the works proposed in the Bill, in detail. The opposition was narrowed down to this: The Duke of Sutherland objected to some of the proposed works, and the Wellington Urban District Council objected to a transfer of a portion of their area. He was informed that there was no appearance on the Hadley petition. The promoters would be prepared to supply the Duke of Sutherland with any amount of water he might require (at 6d. per 1000 gallons), and would carry it in their mains, though they did not propose to find pipes in order to convey the water to the houses of the Duke's tenants.

On the conclusion of Counsel's statement, it was announced that the Wolverhampton petition had been withdrawn—terms having been arranged.

Mr. *J. A. Holmes*, the Clerk to the Oakengates and Dawley District Council, gave evidence in support of Counsel's opening statement. The basis of the present scheme, in the event of there being a deficiency, was that the mean of the rateable value and population of the various areas should be arrived at, and on this the charge laid.

In cross-examination by Mr. LEWIS COWARD, witness said they proposed to sink a well on his Grace's land, and to carry a line of pipes down his private road. The only portion of his estate they proposed to supply was Donnington Wood.

Mr. COWARD: Suppose you have your pipe and supply the rest of your area, but strike out Donnington Wood, will that do for you?

Mr. RAM said the proposition was made now for the first time; and he should like to consider it. If the scheme could be accepted, without Donnington Wood ward, they would leave it out.

Mr. COWARD said the Duke desired that there should be a water supply. His Grace was, however, advised that he could supply the whole of his estate from Hylton Farm; and he was prepared to do so. But he objected to the cutting off, in a somewhat arbitrary way, of a portion of the estate. The Duke did not object to water being taken from his land under the Bill, providing there were certain protective clauses.

Mr. RAM suggested an adjournment in order that the parties might confer.

On the parties re-assembling,

Mr. RAM said that the proposal made by Mr. Coward had been carefully considered; and the promoters had decided to accept it. A difficulty had arisen, however, which his learned friend had not foreseen. A part of the Duke of Sutherland's estate was in the district of Oakengates; and the undertaking given as to Donnington could not apply to this. So far as value was concerned, there was nothing in it; but he (Mr. Ram) could not consent to the proposed arrangement so far as that section of the area was concerned.

Mr. COWARD said that, under the circumstances, he would not press his request so far as the Oakengates portion was concerned. His Grace would undertake, with all convenient speed, to supply water for the whole of the parish of Lillieshall, including Donnington Wood. There would be no opposition to the well and pumping-station proposed provided that the area was fixed at 2 miles in place of 1¾ miles, and provided his Grace were protected in that part of the district in which the water-pipes would run through some of his most valuable covers.

Dr. *Wheatley*, the Medical Officer of Health for the County of Shropshire, stated that there was no part of the district in which the necessity for water was not very great. The more crowded parts of Oakengates, Dawley, and Hadley were supplied from polluted wells.

Mr. *G. Taylor* also spoke in support of the Bill. A supply of 20 gallons per head daily would be sufficient for both domestic and trade purposes. The Wellington Urban District Council had rights of supply in the part of Wellington rural district which, together with Hadley, it was proposed to include in the area of the Bill; but the water of the District Council was only just sufficient for the area they now actually supplied.

Monday, June 13.

Mr. *Taylor* was further examined by Mr. RAM this morning. He stated what he calculated would be the effect, financially, if the portions of Hadley and Wellington rural district were left out of the scheme. Quite apart from the desirability of supplying water to the places in dispute, if these places were omitted, the scheme, as regarded the remainder of the district (which admittedly required more water), would be much more expensive; and it would probably not be self-supporting till the sinking fund had been paid off.

The agreement between the Urban District Council of Wellington and the Company who proposed to supply water to persons who wished to have it in Hadley was here put in.

Witness, in reply to Mr. RAM, said the arrangement proposed in the agreement was a very unsatisfactory one. The supply would be by meter at the rate of 8d. per 1000 gallons up to 4 million gallons, and additional water beyond that at 1s. per 1000 gallons. This would give the population a supply of 3½ gallons per head per day. Under the scheme of the Bill, 20 gallons per head per day would be provided; and the price would be much less than that under the agreement. The agreement did not propose to supply the outlying portions of Hadley. Ketley was not dealt with in the agreement.

Mr. HUTCHINSON: Give a precedent where Parliament has ever authorized the taking away of part of an undertaking, leaving the rest to jog along as best it can?

Witness: I don't know of a precedent in water undertakings. I have known one in the case of gas undertakings—the Golbourne case.

In re-examination, witness said there was no intention on the part of the Joint Water Board under the Bill to abandon any part of their district.

The MARQUIS OF WINCHESTER: All parts of the district which may be given to them they undertake to supply with water?

Witness: Yes.

In further re-examination, witness said that the petitioners had agreed to sell that part of the area of their supply about which they were now disputing for £200.

Mr. *Geo. R. Strachan* gave evidence corroborating that of the previous witness. He said the scheme of the Bill was very sound, and that it would effectually supply the district proposed. On the basis of three dry years, he calculated that Wellington had a supply of 130,000 gallons daily, and no more, which was only just sufficient for themselves at the present time. The terms of purchase proposed in the Bill were such that the Wellington Council would be paid fully by the promoters for every interest they had in the area in dispute. He regarded the agreement between the Wellington Council and Hadley as conclusive evidence that Wellington was not at present able to give an adequate supply of water.

Mr. *J. S. Jones*, the Chairman of the Wellington Parish Council, also gave evidence. He said the Bill had formed the subject of discussion in the Council; and though it was stated that, in the event of its passing, a rate-in-aid would have to be levied, ten members voted for the measure and four against—one remaining neutral. The Council consisted of 15 members.

Mr. *R. E. W. Berrington* said that in June, 1901, he was called in to advise the Wellington Council with regard to their water supply, and had reported to them that it was necessary to extend the undertaking considerably. If they went in for storage reservoirs, the expenditure would be from £16,000 to £20,000; if a pumping scheme, a capital expenditure of £10,000 would be necessary.

Mr. RAM said that, in view of the tendency of the cross-examination, it was only fair to say that if Hadley and Wellington were omitted from the Bill, it would be impossible to go on with the scheme so far as Oakengates and Dawley were concerned.

Mr. *J. Bowen Jones*, J.P., a member of the Salop County Council, said the Council had done its best to procure an efficient water supply for the district dealt with in the Bill. Oakengates had applied to them to do their best to secure a water supply; and as a result a conference of all the local authorities was held on July 2, 1902, at which resolutions were passed declaring that it was desirable to form a united water district. Hadley sent representatives to the conference; and after acting with the other members for twelve months, in October, 1903, they surprised their colleagues by objecting to the scheme.

In cross-examination witness said that the representatives of Hadley had withdrawn from the Water Board scheme for the reason that they were to be charged a rate-in-aid.

This concluded the promoters' case.

Mr. COWARD, for the Duke of Sutherland, said that the arrangement which was indicated on Friday between the promoters and His Grace had been finally made.

Mr. HUTCHINSON then addressed the Committee for the Wellington Urban District Council, stating that he did not propose to call witnesses but relied upon the evidence given by the other side. He maintained that there was no precedent for the Bill, and that there was no proof that there had been a dereliction of duty on the part of his clients. The water supplied by the Council was good. The authority that had not discharged its duty was not the Wellington Urban District Council, but the Wellington Rural District Council.

Mr. RAM said that as no evidence had been called by the petitioners he was unable to reply on the general case. He was at liberty, however, to deal with the precedents quoted by his learned friend; and this he did. He denied that the Rawtenstall case was a precedent, pointing out that the petitioners could not be injured, as they would be recouped for everything they had expended.

The Committee, having deliberated in private, found that the preamble of the Bill was not proved so far as the inclusion of Hadley and Wellington rural parishes were concerned.

The CHAIRMAN inquired whether, under the circumstances, the promoters would proceed with the measure.

Mr. RAM said that, according to his instructions, the Bill would be useless if the parishes named were excluded. He would, however, consult his clients in the matter.

Tuesday, June 14.

Mr. RAM announced that, despite his statement on the previous day—that the promoters would not be able to proceed with the Bill under the altered conditions—they had been approached by the Wellington Urban District Council, and as a result had determined to take the measure as passed by the Committee. The Urban District Council had pointed out that it would be desirable for them to take water in bulk from the proposed Water Board in order to supply Hadley and Wellington rural. The necessity of water being supplied by the Joint Board for this purpose had been part of the promoters' case. This proposal made it possible to go on with the Bill, though the promoters would not get the return for their expenditure which they would have had if they had been allowed to supply Hadley and Wellington rural under their scheme.

The COMMITTEE allowed a period of fifty years for the repayment of loans under the Bill, and agreed to alter the wording of the measure in order to enable the Wellington Rural District (which was no longer one of the "constituent" authorities), to pay their share of the cost of obtaining the Act.

LEGAL INTELLIGENCE.

HIGH COURT OF IRELAND—CHANCERY DIVISION.

(*Before Mr. Justice* BARTON.)

Thursday, June 23.

Thompson and Son v. The Corporation of Belfast.—An Alleged Nuisance from the Gas-Works.

To-day, the hearing was resumed of the case in which Messrs. William and Hugh Thompson, trading as James Thompson and Son, a firm of linen and cambric handkerchief manufacturers in Belfast, sued the Corporation, as proprietors of the gas-works, to recover damages laid at £1500, and sought an injunction to restrain the defendants from causing or permitting smoke, effluvia, and noxious gases to issue from the works so as to cause nuisance or injury to the plaintiffs.

Mr. C. E. MATHESON, K.C., Mr. A. H. BATES, K.C., and Mr. W. M. WHITAKER appeared for the plaintiffs; and Mr. JOHN GORDON, K.C., M.P., Mr. R. H. HARRISON, K.C., and Mr. A. K. OVEREND represented the defendants.

Mr. BATES read a number of documents, including minutes of the Public Health Committee, from which it appeared that complaints of the nuisance from the gas-works were made in April, 1901, and referred to the Sanitary Officer to report upon. It was stated that there was a nuisance caused by dense volumes of smoke issuing from the retort-house and furnaces. Mr. Ward, Assistant Executive Sanitary Officer, reported to the same effect. A deputation waited on the Gas and Electric Committee, and urged them to take steps to abate the nuisance. In November, 1902, Councillor Dempsey complained of the state of the atmosphere in the works, and suggested that efforts should be made to purify it. Mr. Stelfox then determined on the use of dust arrestors. Minutes were read showing that claims had been made from time to time against the Corporation by persons suffering from the nuisance; and also a report by Mr. Stelfox and one from a gas expert stating that as far back as 1892 the works were congested.

This closed the case for the plaintiffs.

Mr. GORDON said there were two or three preliminary matters which he would like his Lordship to bear in mind. The very documents which had been read by the other side had disclosed the greatest anxiety on the part of the Corporation to prevent anything which would give rise to reasonable complaints from people living in the neighbourhood—and this apart altogether from their liability in point of law. Their object was to see whether anyone had a reasonable complaint in the matter, whether they had a legal ground of action against the Corporation or not. The Corporation did all they could to prevent anyone suffering from an injustice. The position of affairs presented a twofold aspect. It first presented itself from the aspect of the conditions under which the Corporation employees were working in the retort-house. This underlay Mr. Stelfox's report; for he

was considering the ventilation of the place inside as well as the effect the smoke might have on people in the neighbourhood. When Mr. Calwell (the first witness for the plaintiffs) was pressed as to what could be done to remedy the alleged nuisance, he suggested a thing which it was impossible to do owing to the heat conditions, which prevented the fans from working. A report was read suggesting that the Corporation should take over a portion of Ormeau Park; but this could not be done without an Act of Parliament. Since the date of the report, the manufacture of water gas had been introduced; and now 45 per cent. of the gas manufactured in the works was water gas. So that, in point of fact, there was less coal gas made at present than before 1892; and the reports received by plaintiffs were therefore utterly beside the case. As to there being no room for the new retort-house in the works, the fact remained that the house was built there, and was built upon ground which the Corporation had a right to build gas-works upon. In the summer time, the retort-house in question was not working; but in the winter, if an injunction was granted, a considerable portion of Belfast would be left without light. If his clients were not allowed to use the house by his Lordship's order, the Corporation had no other ground on which they could erect a retort-house. If they had to go to Parliament, it would be a year or fifteen months before they could obtain an Act; and meanwhile the Belfast people would be in darkness. Taking this into account, let them see what Mr. Thompson complained of. He carried on a large business with considerable success; but men could not be too fastidious. They could not expect that every industry was to cease because they required specially clear air and an atmosphere free from impurities. This meant, as the Lord Chancellor had said in a recent case, that they must bear what people ought to expect to bear in the centre of a great city.

His LORDSHIP: That decision is a little more favourable to your clients than former judgments.

Mr. GORDON (continuing) said the business of Messrs. Thompson had been in existence for a long period; but so far as the gas-works coming to their neighbourhood in 1871 was concerned, there had been no change in the works except for the erection of the retort-house, which was put up before Messrs. Thompson commenced their laundry. The plaintiffs knew the conditions that existed from 1871 down to 1902; and yet in 1902, when the retort-house was in use, they built a laundry. The openings complained of in the roof of the retort-house were made in 1901.

Mr. BATES pointed out that the laundry was in existence at the time. All that was erected in 1902 was the boiler and chimney.

Mr. GORDON said it was from the laundry the handkerchiefs with the smuts were produced; and they had it that the retort-house was in use before the laundry was fitted up. As to the business carried on by the plaintiffs, great care was required to be taken of linen and similar productions; but this was no ground for an injunction. It had not been proved that irreparable injury was done to the goods. At all times some dust or dirt would come in, even if there were no gas-works; and precautions had to be taken to prevent the goods being soiled. But there had been no direct evidence that the colley had come from this particular retort-house, which was some 65 feet high. Taking all the circumstances into consideration, he contended that no sufficient case had been made out which would compel his Lordship to grant an injunction. If reasonable means could be suggested by plaintiffs which would remove any injury (if there were any) caused to them, even though it were not such an injury as the Corporation would be responsible for, or in respect of which an injunction could be granted, the Corporation would willingly do anything to meet them. What they objected to was that a decree should be made which would put an end to their carrying on the works, and prove injurious to the people of Belfast. The mere fact that occasionally some injury was caused was not enough to entitle an injunction to be granted. The nuisance must be something which was really substantial and outside the ordinary limits of reasonable use of a property, which the Corporation had a statutory right to use; and he was satisfied no Court would allow an injunction unless the plaintiffs had made out such a case.

Mr. *James Stelfox*, examined by Mr. HARRISON, said he had been Manager of the gas-works since 1875. The retort-house in question was the last building erected for the manufacture of coal gas. It was commenced in 1890, finished about 1893, and first used in 1896. They began the manufacture of water gas in 1893, and had used it constantly since then. Coal gas was thus dispensed with to a large extent. Public opinion, however, was against water gas; and coal gas was now mixed with it. The largest use of coal at their works was in 1893, when they carbonized something over 112,000 tons. In 1894, by the use of water gas for the half year, this was reduced to 100,000 tons. The universal mode of ventilating retort-houses was through the roof and sides. When the new retort-house was put to work, in October, 1896, it was found that the ventilation was very unsatisfactory, notwithstanding the ridge-flue which had been erected along the top of the house and connected with the large chimney. To remedy this, about the autumn of 1901 a number of openings were made along the upper portion of the north wall. The making of these openings in case of necessity had been provided for in the erection of the building; but the places had meanwhile been temporarily closed in by a thin screen of brickwork. When the wind came from the east, the smoke of the whole house was blown to the Ormeau Road end, and escaped largely through the newly-made openings; and people on the opposite side, near plaintiff's premises, complained that they were annoyed by having the concentrated smoke of the whole place discharged at a low level opposite their windows. The matter was referred to witness, and he could see no means of improving the situation except to make openings in the roof just over the benches, whereby the smoke and steam generated below could gain access to the outer air, and become mixed and attenuated as rapidly as possible. This was the usual practice in retort-houses. Two trial openings were made in 1901 on the northern slope of the roof, at the end farthest from Ormeau Road; and they were found so successful that afterwards, in the same year, eleven others were made. The holes now efficiently ventilated the house. In order to give the issuing air and vapours a velocity, if possible, so as to carry them up to a higher elevation, short funnels were placed over the eleven openings, and had effected a great improvement. The tops of the short ventilating shafts were about 66 feet from the yard level, and 5 feet from the apex of the roof; and the issuing products usually passed over the roofs of the houses on the public road when the wind blew in that direction. Witness did not agree with Professor Tichborne that there were too many retorts in the house for its size; they had ample room. Apart from the gas-works, there was a considerable quantity of smoke in the district. No doubt some smoke and colley came from their works, but no more than from others; and he did not think anything more could be done to lessen the amount of smoke issuing from the new retort-house, without closing it altogether. The accounts given of the smoke and colley on Ormeau Road had been greatly exaggerated. On account of smoke and dust coming from other factories as well as the gas-works, the plaintiffs could never safely leave their windows open, even when the wind was westerly; nothing else could be expected in a large manufacturing city like Belfast, where the atmosphere was always more or less laden with impurities—so much so that it was impossible to leave the windows of dwelling-houses open without getting the curtains black in a very short time. Before the new retort-house was erected, there were as many complaints about the smoke nuisance as at the present time.

Cross-examined by Mr. BATES, witness said the total volume of smoke from the gas-works was not greater now than it was twenty years ago; but at that date there was no smoke near plaintiffs' premises. He did not think that dense volumes of smoke blown against a building from a gas-works at a distance of 70 feet, constituted a nuisance. He had always held that the report of the Sanitary Officer stating that dense volumes of smoke issued from the gas-works was exaggerated; but he did not remember making a written statement to this effect. The old retort-houses were much more open; but he did not make the new retort-house so open owing to the fact that the people would grumble. The ventilation at first was somewhat of a failure; and all their efforts had been to return to the methods in use in older-fashioned retort-houses. Mr. Thompson clearly showed a disadvantage to his business by the smoke; but anything he suffered was in common with other people in the neighbourhood. If the plaintiffs wanted to sell their business, the proximity of the gas-works would not affect the price. At the present time, water gas formed 33 per cent. of the whole manufactured; and in emergency it had risen to 60 per cent. The Beckton Gas-Works were not the nearest approach to those using the same system of ventilation as that employed in the retort-house in Belfast. The system adopted at Leicester resembled the Belfast method very closely, as did also Birmingham. In English and Scotch works, the roofs of the retort-houses were open all the way along, or had louvre openings. The total length of the roof of the new retort-house was 200 feet; and in this distance there were eleven openings of about 7 feet square. In his opinion, this was the same as having the roof open all the way along. Witness had always told the Gas and Electric Committee that no nuisance existed; and he never believed in the fans with which it was proposed to ventilate the retort-house. Experiments with fans had been made with the object of getting rid of steam and fumes for the benefit of the men, and discharging it with as little hurt to the surrounding people as possible. The result was a disappointment, though several people had told him that there had been an improvement.

Re-examined by Mr. GORDON, witness said that, from a scientific point of view, there was no difference in allowing smoke to escape through a long opening in the roof of the retort-house and openings such as he had made. The openings in the sides of the retort-house were to let in air, not to let out smoke. If they had had the water gas sooner, they might not have built the new retort-house at all; but he was not sure that they could now manufacture all their gas without the new building. If one of their other retort-houses broke down, and they had not this new one, they would have nothing as a standby.

Mr. *W. F. Cotton*, Managing-Director of the Alliance and Dublin Gas Consumers' Company, and former Manager of the Company, said he knew the Belfast works. They were not as extensive as those in Dublin. In Dublin, they had manufacturing stations in the city, at Bray, and at Kingstown. In the city station, there were 1330 retorts. He knew the gas-works in London, Liverpool, Manchester, Birmingham, and other centres; and most of them were situated in thickly-populated districts. He had inspected the retort-house in question; and it was constructed on proper principles. The correct mode of ventilation was through the roof; and this was adopted everywhere.

Wednesday, June 29.

Mr. *Cotton*, in further examination, said the retort-house in the city of Dublin was not so high as the one in Belfast. It was an advantage to have the premises higher, so far as the comfort of the neighbourhood was concerned. All the fumes and smoke found their way through the roof; and the funnels in the Belfast house ought to carry off the smoke equally well. The same class of machinery as at Belfast was in use all over England and Scotland. He produced a map showing the situation of the various gas-works in London, and pointed out that they were all in populous places.

Replying to his LORDSHIP, after Mr. Matheson had objected to this evidence, witness said he could not state that they did not create a nuisance.

His LORDSHIP: Then the evidence is misleading.

Witness, in further examination, said he had inspected the exterior of the plaintiffs' factory. The frontage, and that of the houses adjoining, was perfectly clean. The conclusion he came to was that there could not be the amount of smoke and smut that had been deposed to by plaintiffs' witnesses. Except the windows were very defective, they would exclude the smoke.

In cross-examination, witness said people who lived beside gas works had to suffer inconvenience. Gas could not be made without smoke. The retort-house was not working when he was in Belfast. It might be that gas and chemical works were being removed from populous centres.

His LORDSHIP: The plaintiffs' case is that it is possible to manage these gas-works without creating a nuisance; so why introduce evidence about other places?

Mr. MATHESON said what he complained of was that witness was attempting to prove that the gas-works in other places were in populous districts, whereas they were not.

Mr. *H. E. Jones* said he had seen the retort-house in Belfast, and found it well ventilated and constructed on the most modern lines. In his opinion, the higher the openings were carried the better. What came off the coke was little more than steam. The outside of the plaintiffs' premises was clean. He saw flowers growing in the neighbourhood, in a condition altogether inconsistent with the state of things alleged by the p'aintiffs. There was no trace of smoke and colley on the roofs, other than would be expected in a large industrial neighbourhood. There were many mill chimneys around, from which smoke came.

Cross-examined by Mr. BATES, witness said he had counted eighteen such chimneys within a radius of a quarter-of-a-mile; and out of these clouds of black smoke occasionally came. He was not contending that gas could be made without smoke; and if smoke was discharged from these works against plaintiffs' premises, he admitted that it would be a nuisance. But it was not possible for this to occur, because the chimneys were 60 feet high, and the premises of the plaintiff were 40 feet away. The retort-house was a perfect one; and he could not suggest any improvements.

Sir *Charles Cameron*, Medical Officer of Health and City Analyst for Dublin, said he had visited the works. He believed the retort-house was as good as any he had seen. He did not know of any better way of carrying off the smoke; and he did not observe any dust from the quenching of the coke. Carbonic oxide, steam, and hydrogen were given off; and if the coal contained sulphur, sulphuretted hydrogen was also produced. But he found no traces of this. A very small portion of ashes and dust was sent up. He had inspected the plaintiffs' premises; and though the new retort-house was not working at the time, there were traces of colley and dust almost everywhere in their rooms. Some of it, however, was ferruginous street dust, because the road metal in use on the streets contained iron. There were a great many chimneys emitting smoke; and there were carbonaceous particles all through the premises. The atmosphere in Belfast was like that of manufacturing towns generally.

In answer to Mr. BATES, witness said that, in his opinion, plaintiffs were suffering from a nuisance of smoke and street dust. The locality was both manufacturing and residential. The retort-house was about the highest he had ever seen. If it was the case of a new building going to be erected, he would say that the gasholders should be nearer the street, and the retort-house further back towards the river.

Re-examined by Mr. GORDON: There were dwelling houses quite close to the retort-house in Dublin, and also a large school.

Mr. *W. J. Brown*, who said he had been in business for 35 years as a linen finisher quite close to the plaintiffs' premises, stated that no smoke or colley came into his works; but there was ordinary dust. He had no complaint to make about injured goods.

In answer to Mr. BATES, witness said his business was carried on on the ground floor.

Mr. BATES observed that, owing to the position of the premises occupied by this witness, there was a three-storied building between him and the retort-house.

Mrs. *Brown*, the wife of the previous witness, corroborated her husband's evidence; and Mrs. *Tennant*, the owner of a confectionery business in the locality, said she had nothing to complain of.

This concluded the defendants' case.

Mr. HARRISON then addressed the Court, and said the defendants were carrying on a business which they were authorized to do by Act of Parliament, and which they were bound to carry on, using the most approved machinery. There was no more soot last winter than at any time for the past twenty years. He commented on the fact that no gas experts had been examined for the plaintiffs, and contended that the Corporation had operated their works with the best possible plant, and had done all they could to obviate the possibility of nuisance. Belfast was a manufacturing town, and a vast amount of smoke was emitted from other chimneys. Unless the plaintiffs could show that gas should not be manufactured within a certain distance from the road, his clients had a right to succeed.

Thursday, June 30.

Mr. *Cotton* was re-called, and said that the distance from the Great Brunswick Street retort-house in Dublin to the nearest house in Queen's Square was 93 feet; and it was 82 feet to the distillery wall on the other side of the street. Including a garden, it would be 45 feet more to the nearest house; and to the distillery the distance would be at least 106 feet.

Mr. BATES then addressed the Court on behalf of the plaintiffs. He said it was in consequence of the long immunity which the Belfast Corporation had enjoyed in their privilege of creating nuisances that they had made a prolonged and desperate stand for the maintenance of this privilege in what appeared to be a hopeless case. There was one issue—namely, whether the Corporation had been guilty of causing a nuisance affecting the reasonable use by the plaintiffs of their works, and the proper conduct of their business. Once the plaintiffs' case was established on this point, there was no excuse or palliation available in law or in fact to the defendants. Until their defence was put on the files of the Court, the Corporation had never attempted to deny the existence of a nuisance, More than a year before the action was brought, plaintiffs complained; and the reply they got was that the Corporation were going to try and remedy the trouble. On July 11, 1902, Messrs. Thompson wrote a long letter complaining in strong terms; and in answer to this, the Town Clerk said the Gas and Electric Committee had spent considerable sums in making alterations in the ventilation with a view to minimizing any inconvenience. Plaintiffs later on again protested that they could not open their windows, and that the nuisance was getting intolerable. The attitude of Mr. Stelfox apparently was that, unless they had poisoned a man more or less seriously, or unless they inflicted some actual physical injury on his property, they did not create a nuisance to which any liability attached. He seemed to think that, the gas-works being a beneficent undertaking sanctioned by Act of Parliament, they were allowed to do what was necessary in the production of gas, provided the health of the people was not injured or actual physical damage done to their property. If the Corporation, by withholding evidence, could obtain a judicial decision affecting private rights——

Mr. GORDON protested against this allegation. No evidence, he said, had been withheld. The plaintiffs could have subpœnaed anyone they liked. They could have examined Mr. Young, who was Chairman of the Gas Committee at the time.

Mr. BATES remarked that the report of one of the Corporation officials had been withheld. The retort-house, he argued, was defective; and the erecting of it in the place it occupied was an outrage on private rights. Startling propositions of law had been advanced by the other side; and it was contended for the defendants that, as they were a public body exercising public powers to the best of their ability, the law of nuisances ought to be modified for them. But such a proposition was clearly unsustainable, because, even under their own Act, they became liable once it was proved that they were committing a nuisance detrimental to any section of the community in the enjoyment of their legal rights. The plaintiffs had clearly made out their case for damages and an injunction; and he submitted that they were entitled to such relief as would enable them to continue a business which could not be properly carried on so long as it was subject to the nuisance which these gas-works continually emitted.

His LORDSHIP intimated that he would reserve judgment.

Road Opening by Non-Statutory Companies.

A case was heard by the Magistrates at Tipperary last week, in which the Local Authority summoned the Gas Company for opening roads to lay mains. Mr. R. Bruce Anderson, the Engineer, instructed the Resident Manager (Mr. J. Grant) to attend and explain to the Bench that the roads had been re-instated in a workmanlike manner, every care being taken to minimize the inconvenience to the public; and that any damage done was transient and trivial. The result was that the Magistrates fined the Company 6d. and costs.

Laying on Gas without Proper Authority.

At the Watford County Court, on Monday last week, before His Honour Sir Alfred Marten, K.C., and a Jury, the case of *Turner v. Harrow and Stanmore Gas Company* came on for hearing. Mr. Lambert, for the plaintiff, said that this was a claim for damage to his property at Edgware. In April last he was surprised to find a gang of workmen there; the pathway was opened, and holes had been cut in the wall for the purpose of laying gas-pipes. He had not given any permission to the Company to go on to his property, and moreover had a strong objection to gas being laid on to the houses. It appeared that none of the tenants had given any authority to the Company. The Secretary of the Company had stated, in reply to a complaint, that a man who was thought to be an agent for the whole of the property had given the necessary permission. Mr. Hodges, for the defence, said the Company had paid £4 10s. into Court, and were quite willing to restore the property to its original condition. Evidence having been given as to the damage done, the Jury found for the plaintiff; assessing the damages at £6. His Honour gave judgment for this amount with costs.

Charge of Embezzlement Against a Secretary.

At Longton, last Thursday, the charges of embezzlement against Mr. Joseph Speakman, the Secretary to the Longton Corporation Gas Committee, were further gone into. The specific charges against the accused were that he had received on behalf of the Committee, and appropriated to his own use, various sums of money amounting to upwards of £700; and that he had omitted them from the receipt and cash books and ledgers with intent to defraud. The Town Clerk (Mr. G. C. Kent) stated that the accused had been Secretary and Cashier at the gas-works since 1899; having been promoted from the position of clerk. His salary as clerk was 25s. a week; but as Secretary he received £120 a year. The defalcations amounted altogether to more than £4000, the bulk of which had occurred since the audit of the accounts for the year ended March 31, 1903. The money had gone mainly in betting; and it was to be regretted that, for the present at all events, the accused should stand alone where he did. The amounts taken had been received particularly in connection with the sale of residuals. The number of customers being limited, and the separate accounts being mostly of a very large amount, it was comparatively easy for cheques to be appropriated, without the deficiency being discovered for some time. Within the ten weeks prior to his arrest, the accused had stolen £1300, every penny of which had been thrown away in betting. After a long investigation, the prisoner was committed for trial at the forthcoming Stafford Assizes; the Magistrates consenting to accept bail in the sum of £1000.

New Gasholder at Bath.—An event of importance to the city of Bath and its gas consumers occurred at the works of the Bath Gas Company last Wednesday, when the Chairman (Colonel R. L. Taylor, C.B.) turned on the gas to the new holder which has been erected by Messrs. Clayton, Son, and Co., Limited, of Leeds, in a tank constructed by Messrs. Thomas Vale and Sons, Limited, of Stourport. The Chairman, in declaring the holder available for supplying gas, congratulated the Engineer and Manager (Mr. C. Stafford Ellery), who designed it, on the successful manner in which the erection had been carried out, and on the satisfactory work of the Contractors. He expressed his pleasure that the requirements of the gas consumers of the city would be provided for for many years to come.

MISCELLANEOUS NEWS.

THE COMMITTEE ON METROPOLITAN GAS TESTING.

ABSTRACT OF THE EVIDENCE.

Seventh Day.—Monday, March 14.

Sir GEORGE LIVESEY.

The evidence-in-chief of this witness was, in the first place, historical in character, and that we must pass over, after mentioning one or two personal matters. It is well-known throughout the gas industry that Sir George's connection with it has been life long; but there are a few dates which transpire in the opening sentences of his evidence which may usefully be put on record. It was in 1839 that his father, after 18 years' service with the Gaslight Company, became Secretary and Manager of the South Metropolitan Gas Company, and went to reside close to the works. In 1848, Sir George entered the same service; was appointed Engineer in 1862; and, on his father's death in 1871, he also undertook the secretarial duties—holding the double office until 1882. In that year, he went on to the Board as Deputy-Chairman, and became Chairman in 1885. The witness traced the history of gas supply from the days of competition to 1860, by which year, through districting and amalgamation, gas supply had become practically a monopoly throughout the kingdom. Naturally, said Sir George, such conditions raised the question of the protection of the public. The South London Companies felt this; and accompanying the districting, they made arrangements for the testing of their gas by an independent officer, in whom all parties had confidence. Mr. Warrington, of Apothecaries' Hall, was the examiner selected; and he made periodical tests at the works of the several Companies whenever he pleased—generally about once a month—and in the case of the South Metropolitan Company, it was the duty of witness to see him. Thus began the system of gas testing in North and South London, which has, by its ultimate development, caused so much difficulty to the Gas Companies, and so much worry and anxiety (more than all the rest of the business put together) to their officers—constantly distracting and diverting their attention from vastly more important duties; binding the Companies by cast-iron rules to antiquated methods; entailing a large and useless expenditure of capital; and perhaps worse than all, making the price of gas at least 2d. per 1000 cubic feet more than it would otherwise be—representing a loss to the consumers of the three London Companies of certainly £300,000 a year; and with all this on one side, it has never done an atom of good on the other. The Metropolis Gas Act of 1860 prescribed limitations of price and dividend; that 12 sperm candles should be the illuminating power; and, with respect to purity, specified that the gas should "be so far free from ammonia and sulphuretted hydrogen that it shall not discolour either tumeric paper or paper imbued with acetate or carbonate of lead when those tests are exposed to a current of gas issuing for one minute under a pressure of five-tenths of an inch of water, and shall not contain more than 20 grains of sulphur in any form in 100 cubic feet of gas." The tests for ammonia and sulphuretted hydrogen (said witness) worked quite satisfactorily to all parties, but the other sulphur limit of 20 grains was a dead-letter—it being found impossible to comply without the use of lime; and the remembrance of the great nuisance it caused was an effectual bar to its resumption. This sulphur fad originated with Dr. Letheby, when Medical Officer for the City of London, and acting as the Gas Examiner of the Great Central Company's gas in the fifties. At or about 1850, lime for purification had been displaced by the clean and innocuous oxide of iron; and the abolition of the nuisance of lime was a very great relief to the neighbourhood of gas-works. The neighbourhoods may have come to regard the nuisance as unavoidable, and something they must endure; but it was most certainly there. The Commercial Gas Company had now three gas-works, and the South Metropolitan Company six; and all but one of each Company were in crowded neighbourhoods. When the sulphur purification went wrong, it was found that the best thing to do was nothing, but simply work the purifiers in the ordinary way until it got right, because the more one tried to put it right, the worst it usually became.

Following up this subject, it was observed by Sir George that it did not appear there was any well-founded idea of the amount of sulphur in a gas-lighted room; and he had never heard of any experiments by anyone to determine this point until the South Metropolitan Gas Company, on his suggestion, took the matter in hand six months ago. The results of these experiments would be put fully before the Committee by Mr. Otto Hehner and Dr. Rideal, who made them for the Company. It had been said that "air vitiated by the consumption of gas to the extent of 30 volumes of carbonic acid in 10,000 would usually contain less $\frac{30}{1500} = 0{\cdot}02$ volume of sulphurous acid per 10,000 of air, or about 1 part in 500,000." This, witness declared, was simply an inference, and was nearly ten times the reality, as Mr. Hehner and Dr. Rideal would prove. The sulphur restrictions had, he proceeded to say, added enormously to the capital expenditure of the Companies, compelling them to double their purifiers, for which the consumers had had to pay. The sulphur compounds had been reduced to an average, with oxide purification only, of under 34 grains in 100 cubic feet of gas, as was shown by a table giving the official tests of the South Metropolitan Company's gas made by the Metropolitan Board of Works under the Referees before they put any limit on the quantity of sulphur. The tests extended over three years from July, 1870, to June 1873. The averages were (from Newcastle coal): 1870, 33·3 grains; 1871, 31·9 grains; 1872, 33·6 grains; 1873, 34·6 grains. Witness here put in a list of all the undertakings in the kingdom authorized by Act of Parliament or Provisional Order from 1880 to 1903 inclusive, to show how small a proportion are subject to sulphur restrictions. There were, witness pointed out, 470 companies, and 232 local authorities supplying gas—a total of 702. Only 51, or about 7 per cent., had any sulphur restrictions; and among them there were only two local authorities, and they disregarded the requirement. Of the companies, 49 had sulphur restrictions; and one of these—South Shields—were this session granted exemption by a Committee of the House of Commons, on an opposed Bill. Of the 49, 4 had their gas tested daily, 25 occasionally, and 20 were not tested at all for sulphur. Sir George further called attention to the fact that there was no restriction as to sulphur compounds in the Gas-Works Clauses Act; neither did the Board of Trade or the Local Government Board insert such restrictions in Provisional Orders. At none of the great cities on the Continent were sulphur restrictions in force—for example, Paris, Berlin, Vienna, Brussels, &c. English coal was very largely, often exclusively, used in France for gas making; but, so far as witness could discover, there were not any gas-works in France where there were any restrictions, or where any notice was taken of the sulphur compounds. At five of the towns supplied with gas by the Imperial Continental Gas Association, there were sulphur restrictions in the respective concessions expressed in grammes per cubic metre:—

	Grammes.	Tests.	Purified with
Aix-la-Chapelle	60	Monthly	Oxide, with very little lime.
Antwerp	60	Monthly	Oxide (twelve boxes). Lime (four boxes).
Brussels	40	Not tested	Oxide only.
Frankfort	60	Not tested	
Hanover	50	Weekly	

This meant that, even where there were restrictions in the concessions, they were disregarded; for oxide practically did little or nothing in reducing the sulphur compounds. What he held was that what was good enough for all the world, except 7 per cent. of English gas undertakings, was good enough for London. Either the 93 per cent. should be brought under the restrictions, or the 7 per cent. should be freed. The nuisance of lime purification to the neighbourhood of gas-works, the disagreeable character of the work for the purifying men, and the serious question of the disposal of the foul lime, were commented upon. Then Sir George stated that, if, as he had always held and fully believed, this infinitesimal quantity of sulphur did no harm to anyone or anything, the Companies should be at once relieved, and the consumers saved the cost of a refinement of purification that was not of the slightest advantage to them. It was only by pennies and halfpence per 1000 cubic feet that savings could now be effected in the manufacture of gas.

The flagrant violation of the clause defining the qualifications of the Gas Referees, in spite of repeated protests to the Board of Trade, was brought to the attention of the Committee; and then witness dealt at length with the question of the test-burner. Witness quoted section 43 of the City of London Gas Act of 1868 and section 29 of the South Metropolitan Gas Act of 1869: "The Gas Referees shall prescribe the burner for testing the illuminating power of the gas, and it shall be such as shall be the most suitable for obtaining from the gas the greatest amount of light, and be practicable for use by the consumer;" and then he traced the history of the genesis and application of the test-burner for 16-candle gas, until he came to the method of using it, as prescribed in the South Metropolitan Company's Act of 1900 for 14-candle gas. This method, he pointed out, was part of the bargain, and the matter could not be reopened, except by a gross breach of faith. They had a fair fight over it; and the County Council should abide by the result. He had charge of the Bill; and he knew it would be most unfair to the gas to burn it either at the rate of 5 cubic feet an hour, or at a 14-candle rate, in the 16-candle burner. Had any such condition been imposed, he should at once have withdrawn the Bill. The Company, in consideration of the reduction of illuminating power, tested in the way described in the Act, gave up 2d. of the initial price, which meant that they must reduce the selling price 2d. (equal to £90,000 a year to the consumers) if they were not to suffer a reduction of dividend. It was the fact that the reduction of the illuminating power had not yet nearly effected this amount of saving—it was only about ½d. per candle; and, this being so, the Company might, if they adopted the tactics of the London County Council, ask for a return of 1d. of the initial price. To test the gas as the Council wished, would require the supply of 15-candle gas; and seeing that ordinary Durham coal, without a proportion of the best and highest price coal from that field would not produce 14-candle gas, the main object of the change—the doing away with enrichment—would not have been obtained. At the present time, the Company were obliged to use a considerable quantity—somewhere about 25 per cent.—of high-class coal to make 14-candle gas.

Pressing further his contentions, Sir George brought Mr. Vernon Harcourt's past utterances in as witness to the merits of the Company's case. On Feb. 13, 1890, the late Mr. John Methven read a paper on the subject of photometry at the meeting of the Southern Association of Gas Engineers; and Mr. Harcourt was present. In the discussion on the paper, Mr. Harcourt said:

> With the "London" argand, if the consumption were reduced by one-fifth, the yield of light sank to about one-half; and from the same causes, if the actual quality of the gas was somewhat low, the yield of light, with a consumption limited to 5 cubic feet per hour, was reduced. Thus any deficiency in the gas was much exaggerated. A more just estimate would be formed by setting the light of the burner equal to 16 candles, and observing the rate of consumption. This should not be lost sight of in any future legislation touching the mode of testing the illuminating power of gas.

From that time, the 5 cubic feet per hour rate was doomed; and the Referees themselves abolished it. Mr. Harcourt also a good many years ago, made the suggestion that the initial price under the sliding-scale should be governed by the illuminating power of the gas. This principle was adopted in the 1900 Bill. Then as to testing, there was no question. The Referees had introduced the table photometer, and had prescribed the 16-candle rate of burning the gas, instead of the old plan of 5 cubic feet per hour. The Company knew how unfair the 5 cubic feet per hour rate would be to 14-candle gas; and after Mr. Harcourt's advice (as quoted above) they never thought of any other

method. Moreover, he (Sir George) had received a letter from Mr. Harcourt dated March 11, 1900, in which he said:

I am at present inclined to think the price and the illuminating power should vary in direct proportion. I think also that 14 candles is a reasonable minimum—that is, gas which would give a light of 16 candles when burning from the "London" argand at the rate of 5·7 cubic feet per hour.

Again, when before the Parliamentary Committee in 1900, the Chairman (Mr. Oldroyd) put this question to Mr. Harcourt:

In practice does an inferior gas, of (say) 14 candles, require more than a seventh increase in quantity to give an illuminating power equal to 16 candles?

Mr. Harcourt's reply was:

Yes, as 14 candles would be now defined, it would be on the assumption of an exact proportionality between those two; so that 14-candle gas in relation to 16-candle gas would be gas which needed to be burnt at the rate of eight when the 16-candle gas need only be burnt at the rate of seven. This proportionality is assumed in the method of testing and of calculating the results of the testing.

After this, said Sir George, he thought he need say no more. It was all a question of a proper air supply. He did not recommend a series of standard burners for the testing of gas of different qualities, as there would be the serious objection that it would be multiplying standards. It was far better to keep to one standard, if possible. The "London" argand, with gas burnt at such a rate as to yield the maximum light for which the burner was designed—viz., either a 3-inch flame or the 16-candle rate—was, if used in this way, suitable for a considerable range in the quality of the gas, at any rate, from 17 to 12 candles. Therefore, to retain it as the standard test-burner for as great a range as possible, would be the best and most simple course.

Passing on to speak of the result of the reduction of the illuminating power of the gas in South London, witness said it had proved the mistake of those who asserted that it would cause an enormous loss to the consumers. The Company undertook to change, at the option of the consumers, gratis, all their flat-flame burners for one made by Mr. William Sugg for 14-candle gas, which, tested with gas of 14½-candle power, gave a light of 13 candles. A vast number of the flat-flame burners exchanged were tested; and they averaged only a little over 9 candles—ranging from 5 to 13 candles. The result had been that the consumers obtained considerably more light with the new burners from the 14-candle gas than they previously realized with their own burners from 16-candle gas. Instead of the general consumption increasing, it had actually decreased, as the rate of increase was not equal to the increase in the number of consumers. Just recently the Engineer of the Crystal Palace Gas Company (Mr. S. Y. Shoubridge) and himself made independent estimates of the proportion of gas used otherwise than with luminous flames. Mr. Shoubridge's estimate was 72 per cent.; and he (Sir George) could not bring his as low as 70 per cent. The time was fast approaching when the flat-flame system of burning gas might be ignored, and a quality of gas supplied most suitable for use in the bunsen burner, adaptable for all purposes. This position had not yet been reached—mainly because they did not know how to make gas that would suit their purpose. They could only go by steps; and for this the companies needed the utmost possible freedom to make the necessary experiments. What the public wanted, could only be ascertained by direct experiment on the large working scale. The great desideratum was a cheap gaseous fuel that could be used generally for heating and all other purposes for which gas was now employed. The first step was to stop the necessity for enrichment by reducing the standard illuminating power to that readily obtainable from the available supply of coal; and the second step would be to alter the methods of carbonization in order to get the largest possible quantity of gas from the coal regardless of illuminating power, which would involve many practical experiments on a working scale. If a large quantity of 10-candle genuine coal gas could be produced per ton of coal, a very satisfactory move would be made. Probably in the future, supposing further developments in the direction of low-power gas to be desirable, some combination of coal and water gas would be the ultimate result. Competition was also another reason why greater freedom should be given to the gas industry.

Having mentioned that in 1902, the South Metropolitan Gas Company introduced a Bill for the abolition of the Referees with compensation for loss of office, witness said that such regulations as may be really necessary should be definitely set out in an Act of Parliament as was done in the Gas-Works Clauses Amendment Act of 1871, which was what the Company asked for in 1902. *The regulations as to testing, &c., should be such as honest men can comply with without difficulty, and without anxiety.* He put this not as a request, but he claimed it as a simple act of justice. As an instance, he mentioned that it was now admitted that the sulphuretted hydrogen test was ridiculously and most unnecessarily severe. It had necessitated the increase of the purifying plant by about 50 per cent. Four purifiers worked in circuit were quite sufficient for all purposes, though when lime was used, they must be of much greater area than when oxide of iron was the purifying agent. But to arrest the infinitesimal trace of sulphuretted hydrogen that was apt to pass, two additional purifiers had to be employed as catch-boxes. Mr. Harcourt had suggested that a quantitative test for sulphuretted hydrogen might be introduced—the quantity to be limited to 1 grain in 100 cubic feet, or 1 part by volume in 63,500 parts of gas. The average consumption for all purposes of consumers was very near 63,500 cubic feet of gas. Therefore, the ordinary consumer would in the course of the year burn 1 cubic foot of sulphuretted hydrogen. The slot meter consumer only used for lighting and cooking, on an average, some 18,000 cubic feet of gas a year. Therefore, it would take him three-and-a-half years to burn one foot of sulphuretted hydrogen, with a limitation of 1 grain in 100 cubic feet of gas. In a large room or shop with 100 burners, each using 5 cubic feet of gas per hour, and burning three hours per night, one cubic foot of sulphuretted hydrogen would be consumed in about six weeks. He did not say this limit would not be sufficient to give the necessary relief; but he held that the trouble of a quantitative test was unnecessary. The old simple test with acetate of lead paper would answer all requirements. There were other tests that were quite useless—for instance, those for ammonia and pressure. All the daily labour for testing for ammonia was labour lost; and the same could be said of the tests for pressure. The evidence to be given by Mr. Hehner and Dr. Rideal should once for all settle the sulphur bugbear; and the incandescent burner had reduced the question of illuminating power to a matter of no importance. On all these points, therefore, the importance of testing had been reduced to the vanishing point, and the necessity for it had ceased. Of all tests and regulations, there were none to compare in effectiveness with the competition to which gas was now subjected.

The points upon which witness, in reply to members of the Committee, supplemented his evidence were many. In the first place, he explained further the difficulties as to the disposal of spent lime. Referring to the figures he had put in as to the average grains of sulphur in the gas when oxide of iron only was used, he stated that the coal was Newcastle, which was the only available supply in South London—all other coal was out of the question, being too dear. Before oxide of iron was introduced in 1850, gas-works could be smelt for a considerable distance around. Then the gas companies all abandoned the use of lime, and got rid of a great cause of nuisance [until they were compelled to use lime again]. Asked whether, if his Company were free from the sulphur test, he would discard the use of lime altogether, or still use it to absorb the carbonic acid, Sir George said he should discard it altogether. He had thought a great deal about this. At one time when they used oxide, they also employed lime for removing the carbonic acid; but he came to the conclusion that this lime, being an alkali, absorbed a considerable amount of the hydrocarbons of the gas. He remembered that he once had in his garden a heap of lime that had been used; and the gassy smell from it stuck to it for months. It was simply, he believed, the hydrocarbons of the gas that had been taken out in passing through the lime. He made some experiments, testing gas that had been passed through lime and other gases that had not; and he could find no appreciable difference in the illuminating power. One per cent. of carbonic acid was said to reduce the illuminating power 6 per cent.—that was, if the 1 per cent. was put into the gas; but if they had the 1 per cent. in the gas, and took it out, there was not an increase of 6 per cent. in the illuminating power. Referring to the tests of Mr. Hehner and Dr. Rideal, he stated that two rooms of a cottage adjoining the Company's offices in the Old Kent Road were fitted up with apparatus for testing the gas and air. In one room gas purified with oxide only was used, and in the other one gas purified in the ordinary way, with lime, was employed. To their great delight and astonishment, it turned out that it was often found that there was less sulphur in the air of the gas-lighted room than in the open air. As to Dr. Haldane's experiments, in testing gas for sulphur, he used Harcourt's test. The apparatus was very useful; but it was not a reliable test to give the exact proportion. Regarding the test under the Gas-Works Clauses Act, this satisfied all the rest of the kingdom; and he did not see why it should not satisfy London. Anyway, he thought it would be a satisfactory test for his Company. Respecting the figures he had put in as to Continental works, it was only right to say that some of them used Westphalian coal; and he did not think there was so much sulphur in that as in English coal. The European Gas Company supplied a number of towns in France; and, replying to an inquiry as to whether English coal was used exclusively in any French works, the Secretary of the Company wrote: "We use English (Newcastle) coal exclusively at the following works: Boulogne, Caen, Havre, Nantes, and Rouen. English coal is used in Paris, but not exclusively." There was no case in the whole of France where he (Sir George) could find any limitation of the quantity of sulphur. Of course, in the event of the Gas Companies being relieved from the use of lime, it did not follow that they would not make other efforts to remove the sulphur compounds. He believed something might be done with sulphide of ammonium; but, being hampered as they had been, they had been unable to make any experiments. Asked whether he meant to do away with testing altogether, Sir George pointed out that, in the case of gas-supplying corporations, testing was a farce, because who was to test against them? The whole of the testing did no good. For instance, in the case of the South Metropolitan Company, half of their gas for fully three years had not been tested at all. They had had a dispute with the Gas Referees, who would not certify two of the testing-places; and the result was that at least half of the gas distributed by the Company had never in that time been tested by the authorities—of course, the Company had tested it themselves. Nobody, however, was a penny the worse. He did not say there should be no testing at all, but that testing was of no use, though he felt that it would be difficult to convince other people of this. All he asked for was that the conditions should be such that honest men could comply with them without difficulty and anxiety. For thirty years, they had not been able to do this.

In regard to the question of the test-burner, Sir George, in reply to members of the Committee, enlarged on his evidence-in-chief; but the essence is the same as already reported. With reference to the distribution of new burners to the consumers, he stated that the South Metropolitan Company, having got this access to their consumers, intended to keep it. The two years' obligation to supply burners expired last June; but the Company were sending out now with their accounts, the same notice that the consumers could have burners free in exchange for their old ones. There was a curious thing about these new burners. They had had a number of them tested at different rates of consumption, and found that, burning at 13, 14, 15, 16, and 18 tenths pressure, and consuming 5 feet, 5½ feet, 6 feet, 7 feet, and 7½ feet, the illuminating power, calculated to 5 feet an hour, was almost constant, and came out to an average of 12·92 candles—say, 13 candles. So that it was a burner that could be used at varying pressures, and the full effect of the light obtained from it. He attributed this to the stuffing. He preferred it to the governed burner. The governed burner was governed to an exact rate per hour; and they could not get more. With his burner, he could get 19 candles by turning it on to 7½ feet, or he could get 12½ candles. The inquiry was made by the Chairman as to whether it was not rather an anomaly, if the testing of the illuminating power was for the sake of the people who used flat-flame burners, that the testing itself should be by an entirely different burner. Witness said perhaps it was; but they must

have some sort of standard, and the argand seemed to be the best. A further question was as to whether the South Metropolitan Company had reduced the price of their gas proportionately to the diminution in illuminating power. Witness's answer was that the cost of gas into the holder was about 1s. per 1000 cubic feet; this representing something like ¾d. a candle on 16 candles. They had reduced the price 2d. in consequence of the reduction of illuminating power; but they had not saved 2d. There was this extraordinary thing, too. The consumers were burning less gas now than they did with the 16 candle gas. The Company were formerly getting increases of between 6 and 7 per cent. per annum; and the Crystal Palace District Gas Company were getting about the same. When the burners were altered in South London, the decreases dropped to 3 per cent.; and those of the Crystal Palace Company kept up to the 6 per cent. The consumption of the slot consumers averaged 18,000 cubic feet before the burners were altered; and, after the change was made, the consumption averaged 17,000 cubic feet, of which from 8000 to 9000 was used in cooking-stoves—say, half of the consumption; so that there was a drop of 1000 cubic feet from the 9000 feet. As to incandescent mantles, Mr. Carpenter had investigated the lighting arrangements of 90,000 of the consumers; and he found that 75 per cent. of them used incandescent mantles.

Then the Chairman reverted to the method of testing, asking whether Sir George would agree that the gas which, according to the method of testing he had described, gave 14 candles would show as 13 candles if tested at the 5 cubic feet an hour rate. Witness agreed; but he put it another way: If the Company, he said, had to supply gas that gave a light of 14 candles tested in that way, they would have to make 15-candle gas. The method would depreciate the return by a candle. The question which followed was to this effect, Would it make any difference to the Company, if they supplied the same gas as now and at the same price, whether it was called 13 or 14 candle gas? The answer was, only that it would lead the public to suppose they were being supplied with an inferior gas to that for which they were paying. Upon this, it was put to witness that the Gaslight and Coke Company would contend that, if the South Metropolitan gas was called 13 candles in relation to their 16 candles, the facts of the case would be better represented than now. "But," said witness, "you know what Professor Boys told you about the calories in our gas and theirs—that their 16-candle gas was 145 calories, and our 14-candle gas 150 calories. Their gas is a mixture of coal and water gas. I do not want to say anything about water gas. We do not use it. There are many reasons for its use; but if it is used, it ought to be of a uniform quality." Getting back again (at the instance of Mr. William King) on to the rate of consumption in testing, witness said that, if gas of varying qualities were taken and tested in the same burner at the 5 cubic feet an hour rate, they would, as Mr. Harcourt had put it, greatly depreciate the light in proportion to the quality of the gas. On the same question, Mr. Moulton elicited that Sir George preferred "the thing that is uniform to be the amount of light got in the 'London' argand, and the thing that varies to be the gas supply. . . . The 'London' argand burning a very low quality of gas at the 5 feet rate would so frightfully depreciate the light that it would be altogether misleading." This, witness maintained, would have a very prejudicial effect.

One other point, and this synopsis of the extensive but germane evidence tendered by Sir George is finished. He thought it would be possible, in a comparatively short time to get incandescent mantles universally accepted. The sooner it was done the better; and therefore the sooner the flat-flame burner was knocked out of use, the better. The advent of the mantle had brought a cheap heating gas within the range of possibility, which would be the best means of diminishing the smoke nuisance. A great deal had been done in this direction by the slot meter business. Where the consumers used to have open fires for their cooking, 130,000 people in the South Metropolitan district alone had cooking-stoves. If gas suppliers could get the price down to something like 1s. 6d. per 1000 cubic feet, for a fuel gas that would answer all purposes, they would accomplish a great deal for their cities. He thought 1s. 6d. was a figure they might reach; and he hoped they might get below it. The South Metropolitan Company were only 7d. above it now. He had been struggling all his life—the last fifteen years particularly—to get the price of gas down; and here they were where they were ten years ago.

Eighth Day—Tuesday, March 15.

The proceedings commenced to-day by the presentation of the following important—

Statement of Results of Experiments on the Vitiation of Air by Sulphur Compounds.

By Mr. Otto Hehner *and Dr.* Samuel Rideal.

The two most important contributories are coal and gas. We have contrasted the sulphur-content of outside air with that in rooms containing the products of combustion of gas.

Whilst we have made many experiments with a view to differentiate the different sulphur compounds in air, we consider that the total sulphur impurity may be taken as an index of contamination.

We believe that the sulphur impurities in the air of towns have been established with a sufficient degree of accuracy by the Manchester Committee on Fogs, and we have used the apparatus for determining the total sulphur contents of air described in their report. The total sulphur impurity, calculated in volumes of sulphurous acid gas per million may reach, under exceptional circumstances, 4 to 5; but, as a rule, the amounts are considerably less than this; the mean in winter being slightly less than one, and in summer about one-quarter of a, volume.

We have confirmed Lehmann's observation that 5 volumes per million can just be detected by the senses; and the above experiments show that the experience in large towns where sulphur can be smelt during fogs is in agreement with the chemical results.

It is easy to calculate the theoretical sulphur-impurity in a room of 1000 cubic feet, when gas is burning at a rate of 5 cubic feet per hour, from the composition of gas. Taking gas with 20 and 40 grains of sulphur per 100 cubic feet, as representing the two qualities of gas under consideration, and the volume of carbonic acid produced as equal to half the volume of gas burned, it follows that, with the increase of carbonic acid, the sulphur-content of the air would be as follows:—

Volumes CO_2 per 10,000 of Air.	Volumes of Sulphurous Acid per Million of Air.	
	20-Grain Gas.	40-Grain Gas.
8 ..	0·5 ..	1·0
10 ..	0·6 ..	1·2
25 ..	1·6 ..	3·2
50 ..	3·2 ..	6·4

It will be seen from the above that, only when a room is so vitiated that the carbonic acid has reached 50 volumes per 10,000, the sulphur content of the air exceeds the limit of perception, and then corresponds to the maximum impurity as regards sulphur of outside air in foggy weather. In the above table, we have given eight volumes of carbonic acid as being the quantity suggested as a legal limit by the Departmental Committee appointed to inquire into the ventilation of factories and workshops for the carbonic acid contributed to the air by the combustion of gas or oil. We take this opportunity of pointing out that the reporters to the Committee have rightly made no distinction between rooms in which gas of low or high sulphur content is burnt. The sulphur content in any room in which the carbonic acid has been increased by light, is inappreciable whichever gas is used. It is therefore evident that, in the opinion of the Department, the injurious effects of the carbonic acid manifest themselves long before any significance can be attached to the sulphur. This conclusion applies to the carbonic acid due to combustion only.

It is evident from these theoretical considerations that the sulphur contents of gas cannot be of significance in a room which would not be condemned from other considerations.

In actual practice, however, we have proved that the sulphur content of the air is invariably very much smaller than the calculated amount. We have independently proved by a long series of experiments, that the volume of carbonic acid produced by burning coal gas is not a measure of the sulphur impurity produced by combustion. That such a discrepancy must exist in the case of any ordinary room is again theoretically obvious when one considers that the walls and ceilings consist largely of carbonate and caustic lime, both of which energetically absorb sulphur-acids. Direct experiments show that this factor plays a most important part, especially as the products of combustion, being hot, must necessarily first come into contact with the ceiling. The amount of sulphur found by us, when burning different kinds and quantities of gas in an ordinary small room, varied from one-sixth to one-twentieth of the quantity actually introduced. In no case did we find the amount of sulphur impurity in the air larger than one fourth the quantity which, according to Lehmann, can produce irritation of the nose and throat, and in that case the gas contained no less than 46 grains of sulphur per 100 cubic feet, and the air of the room 45 volumes of carbonic acid per 10,000.

Under ordinary conditions, we have found not only no increase in the sulphur content of the air of the room over that in the outside air, but we have even found a decrease, owing to the rapid purification by the walls and ceiling. We have also noticed this purification of the air when no gas was burning in the room.

In no case did the air of the room, under the most adverse conditions, show any fog, or was any smell of sulphur noticeable.

Experiments on the tarnishing of metals have shown that a greater effect was produced by exposure to the outside town air than to the air of the room in which either kind of gas was burning.

The authors of this important statement—Mr. Hehner and Dr. Rideal—were before the Committee during the first part of the sitting for examination; and a large amount of explanation as to the way in which the experiments were conducted was tendered. In the first place, Mr. Hehner stated that they had confirmed Lehmann's observation that 5 volumes of sulphurous acid per million could just be detected by the senses. This would amount, reckoned as sulphur, to just one-half by weight. Parts of sulphurous acid per million divided by 16, were grains of sulphur in 100 cubic feet. Five parts per million were $\frac{5}{16}$ of a grain per 100 feet. Some of the experiments were synthetic. He had volatized in a room of known capacity an exactly known quantity of sulphur, both in the form of sulphurous and sulphuric acid, and thoroughly mixed the gas and the air in the room. An observer then went from the outside air into the room, endeavouring to detect the presence of sulphur. Coming from the outside, an observer would hardly detect the smell; he would notice a sensation, but not necessarily a smell. By taking a deep breath, he would just observe something unusual. With a less quantity, nothing was noticeable. This applied only to sulphurous acid. With sulphuric acid, a smaller quantity was detectable by the eye. One part per million of sulphuric acid made a room slightly foggy. Many analytical experiments had also been made. They had endeavoured to scrub the air, and to discriminate between the sulphuric acid and sulphurous acid formed in combustion. The sulphurous acid they endeavoured to determine in a number of different ways; but they had not been able to obtain exact quantitative results so far as sulphurous acid was concerned. The

total sulphur had been determined in the manner adopted by the Manchester Committee—viz., a measured quantity of air through a tower filled with glass beads, over which hydrogen peroxide was passed; the sulphur being afterwards estimated as sulphuric acid in the form of barium sulphate. In every case, they found in this way a determinable quantity of sulphuric acid, whether the air was taken from outside or inside the room.

Describing the place in which the experiments were conducted, Mr. Hehner said it was a small cottage such as would be occupied by a workman. The rooms were quite small—not quite 1000 cubic feet capacity. Every aperture—all the windows, fireplaces, and so on—were blocked up; so that the conditions should be as unfavourable as could possibly be managed. In the room, gas of various composition was burned. The quantities consumed were exactly measured; and the sulphur that the gas contained was ascertained by the Referees' method. Then the amount of carbonic acid the gas could furnish was determined; as well as the sulphur. The various sulphur compounds in the atmosphere of the room were determined; and, finally, they settled upon the local sulphur as being the only exact measure which could be obtained. The atmosphere of the room was allowed to be highly vitiated; the carbonic acid rising to 50 volumes, or more, in 10,000. Dr. Rideal made a very large number of experiments under many conditions. He (witness) burnt gas at such a rate that the natural ventilation kept pace with the contamination by the burning gas-flame as regarded carbonic acid. One flame was burnt; and from hour to hour the carbonic acid was determined until a balance was obtained. This was sometimes the case after 100 hours' burning. This was done in order that the room should be permanently, and, as far as could be, equally, contaminated. The air in the room was kept in motion by a punkah or fan. Asked to explain what he meant by "natural ventilation," witness said it was such that out of a room of about 900 cubic feet, 500 or 780 cubic feet passed through the walls and ceiling continuously per hour. When a room was puttied up in a cottage of this kind—when it was closed as tight as it could be, with the walls papered and the ceilings whitewashed—then at least once in two hours the air of the room changed; and sometimes the change was much more rapid. This depended on the wind and other conditions, which, of course, could not be regulated. But the contamination was kept as constant as possible at about 50 volumes of carbonic acid per 10,000. Knowing (from analysis) the amount of sulphur in the gas, they expected, of course, to find that there would be a relation between the carbonic acid and the sulphur something like it was to be calculated on the gas; but it was discovered that it was nothing of the kind. They found that the theoretical proportion of sulphur and carbon, or rather the proportion obtained by the analysis of the gas, was no index whatever of the sulphur content of the room. In every case, the sulphur content of the atmosphere was far less—sometimes one-twentieth of that which it ought to have been.

The Committee were anxious to understand clearly how the estimate of the sulphur content was arrived at; and Mr. Hehner explained it as follows: A certain volume of gas was burnt in the room. Samples of the air were continuously withdrawn by an automatic mercury sampler, and the carbonic acid was determined in the samples at frequent intervals. A measured quantity of air was also passed through a tube filled with glass beads (which in some cases was placed in the room, and outside the room in others), in which it was washed with hydrogen peroxide, in order to oxidize whatever sulphur compounds there were. The sulphur was determined. By these means they could calculate the sulphur content of the air; and thus calculate the relation the sulphur content ought to bear to the carbon content of the room. As he had said, in every case, the sulphur was much less than it ought to have been according to the calculation from the quantity of gas burnt in the room and its composition. Synthetic experiments were made. Sulphurous acid was certainly oxidized by hydrogen peroxide, and was easily absorbed. The air was passed through three towers in series; and, if any sulphur escaped, it could not have been present as sulphurous or sulphuric acid. The sulphurous acid was continuously removed as rapidly as it was found. The reason was obvious. A room or a house was a basic scrubber. The whole of the ceilings and walls were made with lime; and there was tremendous ventilation. The air coming in from the outside was scrubbed; and the sulphur acids combined with the lime in the ceilings and walls as quickly as they were formed—so rapidly, that the inside air of the room, although gas was throwing sulphur into the room, was often purer in regard to sulphur than the outside air, which contained only the products of combustion of ordinary fires. If they took the plaster from a room in which gas had been burned, it would be found to contain calcium sulphate. The room was on a large scale what the potash bulb in a chemist's laboratory was on a small scale—it absorbed the acids as rapidly as they were formed. Gas to the amount of 10,000 cubic feet was burned in one room; and they determined the sulphur content of the ceiling, and found it had absorbed 743 grains of sulphur—that was, of the sulphur content, 7½ grains of sulphur were recovered as sulphate in the walls and ceilings; while the gas contained about 12 grains of sulphur in 100 cubic feet. Answering Sir William Abney, witness said that, where they had not got the room hermetically sealed, the flow of what was called "natural ventilation" would not perhaps take place at the same rapid rate. Of course, if the room was not hermetically sealed up, the air would have changed far more rapidly than it did.

Then witness was taken in hand by Mr. Moulton. His first question was: You come to the conclusion that the sulphur content of the air in the house is practically determined by the sulphur content of the outside air? Witness answered that he had not quite considered it in that direction; but he thought there would be some considerable amount of strength in the argument. Of course, one could blaze away with gas so that there would be an increase of the sulphur; but then the amount of carbonic acid would go up to such an extent that the room would not be fit to live in. He had a little table showing this. Supposing no ventilation had taken place at all—supposing they had burnt gas containing 40 grains of sulphur in a room in which there was no ventilation whatever, and they had brought the carbonic acid up to 50 volumes per 10,000 (which was, of course, an altogether unreasonable quantity), then there would be 6 volumes of sulphuric acid per million. A further inquiry brought this point out: That the observers had found that the total sulphur in an ordinary London atmosphere in the winter was 0·3, 0·2, 0·2, 0·5, 0·4 volume per million—going up to 5 volumes in a black fog. The suggestion that the walls and ceilings of a room acted as purifiers struck the Committee as being rather novel; and witness remarked that this was not merely a theory, but a fact proved by the analysis of the air and of the wall. Sulphate of lime was not, he thought, usually employed for plaster; it was employed for stucco. Dr. Rideal and himself had analyzed the ceiling in a passage where very little gas was burnt; and this contained 0·49 per cent. of sulphur. In a room where gas had been burnt, the ceiling contained 0·80 per cent. of sulphur. The Chairman desired to see the experiment tried, as a correlative to the experiment of Mr. Hehner and Dr. Rideal, of the burning of gas in a room or closed place of some kind in which there was no lime present, and so ascertain if they could find the theoretical amount of sulphur. Mr. Hehner said the room could be varnished; and Sir George Livesey said this should be done.

Then Dr. Rideal gave the results of one of his numerous valuable tests from a report dated Dec. 7. Lime-purified gas was burning in one room, and oxide purified gas in another. The total quantity of lime purified gas burned in the one room was 43 cubic feet over a period of ten hours; and, in the other room, 54 cubic feet of the oxide purified gas was burned in the same time. The sulphur content of the two rooms was examined during the first five hours, and during the second period in each case. With the lime purified gas, the figure was 0·0054 for the first five hours; and it increased to 0·0063 for the second five hours; so that the sulphur was slowly gaining on the absorption. In the other room—that was, with the oxide-purified gas with more sulphur—it rose from 0·0175 to 0·0232 in the second five hours. By multiplying by 16, the volumes per million would be obtained. Thus the quantity of sulphur in the room after the oxide-purified gas—the 40-grain gas—had been burning for ten hours was about one-sixteenth that which would be obtained in the outside air on a very foggy day. On that particular day, the outside air was aspirated for 7¼ hours, and yielded 0·0136 grain per 100 cubic feet—about half that which was obtained during the second period in the room with the oxide purified gas. "Is it your conclusion," asked Mr. Moulton, "that in an ordinary room in which as much gas is burnt as is usual, the sulphur contents are rather less than more as compared with the air outside?" Dr. Rideal replied in the affirmative. For a time certainly, even after five hours of gas burning at an ordinary rate, the sulphur content would be less in a small room than in the outside air. "If," interposed Mr. Hehner, "they kept piling it on, then it would gradually rise about that." Among other points that were spoken about, was the fact that the ceiling of a house was whitewashed from time to time; and a good many pounds of whitewash were used. The same witness also stated that he did not attach much importance to the presence of sulphur in the air as being deleterious to health. One proof of this was that pieces of metal exposed outside the room got tarnished; whereas inside they kept clean. It would be annoying to have in a room 5 volumes of sulphur per million; and it would, in his opinion, be impossible, under any ordinary reasonable conditions, to produce 5 volumes of sulphur per million by means of the combustion of coal gas, because the room would then be so vitiated with carbonic acid that this in itself would be much more objectionable than the sulphur.

Further on in the evidence, Dr. Rideal stated that he had determined the quantity of sulphur in kerosenes, and calculated the amount of sulphur that would be evolved by burning paraffin as compared with coal gas, taking the light from an argand burner, and taking the light from an ordinary petroleum burner. He found that the kerosenes contained 12·25 grains of sulphur per gallon; and this would correspond, for equal ordinary illumination, to gas containing from 4·8 grains of sulphur per 100 cubic feet. This was roughly the quantity of sulphur evolved by burning oil that gave the same amount of light as gas. The question was put to Mr. Hehner as to whether he would draw any distinction between gas burned by the Welsbach mantle, and the same quantity of gas burnt in a luminous flame, as to the probable products of combustion. His reply was that he thought not; he believed the products, as far as they knew, were the same. Dr. Rideal thought there was more sulphuric acid produced in an incandescent mantle than in an ordinary burner. The mantle acted as a contact material, and seemed to determine the combustion more to sulphuric acid than to a mixture of sulphurous and sulphuric acid. He took it that the products of combustion of the outside air were more sulphurous than sulphuric. The ordinary batswing and argand burner would give a mixture of sulphurous and sulphuric acid, or sulphur incompletely and completely oxidized; but the incandescent mantle would give almost completely oxidized sulphur.

It was arranged that the Committee should visit the works of the South Metropolitan Company on March 29 to witness the experiments referred to.

Sir George Livesey, recalled.

Supplementing his previous evidence, Sir George Livesey gave a large amount of information as to the advantages of incandescent lighting, by which six times the amount of light could be obtained under ordinary conditions as compared with the flat-flame burner. He believed it would be the general system of lighting in the future. The smaller consumption of gas occasioned by incandescent lighting, the durability of mantles, the question of maintenance, and of cost were touched upon. Then he explained what was being done by way of trial at East Greenwich with small retorts to see what could be accomplished by that means in increasing the production of gas; and this brought him to a reference to the Settle-Padfield vertical retort, by which practically continuous carbonization goes on. In this system, he explained, the coal was fed in in small quantities; and he believed they got from 12,000 to 13,000 cubic feet of gas per ton and no tar. What one would like to do, he said, would be to take half the tar off the market. The value of tar now was just about the same as it was when it was only used for its pitch, its naphtha, and its creosote. Notwithstanding all the wonderful products from tar, the Germans had got such a hold of it, that it only fetched the same price as it did forty years ago. Now, if gas-works could take half the tar off the market, they would get a

reasonable price for the remainder. As the market stood, they would rather make less tar and more gas. When, if ever, it came about that gas was used entirely for its heating power rather than its illuminating value, it should be tested regularly for its calorific power to ascertain the most suitable quality; but it would not be wise to fix a limit until it was ascertained what would be a proper limit. That would be premature at present; but when the necessary standard was known, then the gas ought to be kept up to that standard. After this, the question of testing was again attacked; and Sir George said he had no objection to the limit of illuminating power of 16 candles for 5·7 cubic feet consumption for 14-candle gas. Witness also described the conduct of the Gas Referees which had given rise to the matters in dispute between them and the South Metropolitan Company; and then, on the question of the portable photometer, he stamped it as being absolutely unreliable. The Company had felt the Referees to be very exacting; but they were now treating the Company a little more considerately. Replying to the Chairman, he said he should certainly favour the suggestion of the Gaslight and Coke Company that forfeitures should be assessed by the Chief Gas Examiner (instead of the Companies being hauled before the Magistrates); if there were reasonable conditions, there would be no proceedings at all. Neither did he see any objection to the Company being required to give notice of appeal, or of withdrawal of appeal, to the County Council, as well as to the Chief Gas Examiner.

Ninth Day.—Monday, March 21.

Dr. Frank Clowes.

The only witness examined to-day was Dr. Frank Clowes, the Chief Chemist and Superintending Gas Examiner to the London County Council, on whose behalf he appeared before the Committee. He handed in a long statement divided into three parts. The first part dealt with the illuminating power of the gas, and was divided under the following heads: (1) History of the standard burners; (2) method of testing; (3) standard burner; (4) standard illuminating power; (5) testing in the district controlled by the London County Council; and (6) as to the control of the testing-places. The second part, which was on the subject of impurities in the gas, consisted of: (1) Sulphuretted hydrogen; (2) sulphur compounds other than sulphuretted hydrogen; (3) ammonia; and (4) general statement and recommendations. The third part was made up of tables explanatory of his evidence.

Witness began his statement by referring to the "Birmingham" burner (which was in use generally for testing prior to 1862), Dr. Letheby's model (which was so employed between 1866 and 1870), and Sugg's No. 1 "London" argand (by which all the gas of the three Metropolitan Companies is now tested). He said that Dr. Letheby's burner, when consuming gas at the rate of 5 cubic feet per hour, produced a light of from 13½ to 14 candles for the same gas as yielded, when burnt in the "Birmingham" burner, a light equal to 12 candles only. The No. 1 "London" argand, again, produced a much higher illuminating value than the Letheby 14-candle burner did with the same gas; and, as a matter of fact, the higher lighting power of the gas supplied at the present time, as compared with that furnished between 1860 and 1870, was not due to any improvement in quality. The increase of light had been obtained by the improved method of burning the gas.

In calling attention to the method of testing introduced for the first time into the South Metropolitan Company's Act of 1900, Dr. Clowes remarked that the Company informed their consumers by means of a circular that they desired to reduce the illuminating power by 2 candles; but by the altered method of testing contained in the Bill, the reduction suffered was not 2 candles, but 3 candles. This had been ascertained in the following manner: A holder containing gas which yielded 13 candles when burnt in the standard burner at the rate of 5 cubic feet per hour was connected with the photometer; and the gas supply was so adjusted as to burn the gas at the rate of 5 cubic feet per hour. The illuminating power of this gas would be registered as 13 candles. If the rate of consumption was then increased until a 16-candle flame was obtained, and a correction for consumption was made, the power of this gas would not be 13 candles but 14 candles. So that the consumer would actually receive gas which, when tested by the method in use previous to 1900, was not of 14-candle power, as stated by the Company, but 13 candles. This reduction in illuminating power was, however, considerably increased when the gas was burnt under the two different conditions in a good flat-flame burner instead of in the "London" argand burner. The reduction in the amount of light given by the flat-flame burner supplied by the South Metropolitan Company to their consumers was 19 per cent. when the actual illuminating power of the gas was reduced from 16 to 14 candles. When the gas was reduced to 13 candles, as ascertained by the standard burner consuming it at the rate of 5 cubic feet per hour, the reduction in illuminating power was at least 30 per cent. So far as the consumer was concerned, therefore, the reduction which should be made in the price charged for the gas, was not the 1d. per candle for the professed drop from 16 to 14 candles, but 30 per cent. of the price of the gas for the actual drop to 13 candles. This, at the price ruling when the alteration was made—viz., 2s. 3d. per 1000 cubic feet—would be about 8d., and not 2d.

With regard to the adoption of a standard burner for testing purposes in the future, witness said he thought the present one should be retained, and that the standard rate of consumption of 5 cubic feet per hour should also be retained. If, however, any change was made in the standard burner, he would suggest that a flat-flame burner should be substituted for the present "London" argand—due regard being paid to the difference between the amount of light given by the best flat-flame burner and the "London" argand when burning the same gas at the standard rate of 5 cubic feet per hour. Undoubtedly, gas in the County of London should be tested by a uniform system.

As to the quality of gas most suitable to the consumer, witness recommended not less than 16-candle power as tested with the present standard burner when consuming the gas at a rate of 5 cubic feet per hour. This was what the consumer was accustomed to. There were objections to the use of the incandescent mantle; and in its present condition, its employment could not become general. And even when it was adopted, advantage was usually obtained by burning gas of higher illuminating power, since the calorific value usually rose with the illuminating value. The flat-flame burner supplied to their consumers by the South Metropolitan Company gave a light of 2·8 candles per cubic foot of gas, or 14 candles for 5 cubic feet per hour, when it was burning 16-candle gas. When tested by this burner, therefore, the illuminating power of the gas supply should be not less than 14 candles.

Witness next dealt at length with the portable photometer proposals of the London County Council; maintaining that the only way of assuring to all consumers the supply of gas of the prescribed quality was to legalize this instrument. He explained the scheme embraced in the Council's Bill of 1900, and then referred to the question of control of the testing-places—detailing instances of what he termed "interference with the testing authority."

Coming to the subject of impurities, witness pointed out that during the ten years to Dec. 31 last, there were only eighteen occasions on which sulphuretted hydrogen was reported as being present in the gas supplied by the three Companies to London; and on appeal to the Chief Gas Examiner, thirteen of these reports were cancelled. The removal of sulphuretted hydrogen was not difficult; and the process appeared to have satisfactorily met the present requirements of testing. During the same period, the gas was reported to contain an excess of sulphur (on an average of amounts found on three days) on forty-two occasions. The Chief Gas Examiner was appealed to in all cases; and thirty of the reports were cancelled. Here, again, the Companies had incurred a forfeiture on very few occasions; and the recent concession made by the Gas Referees appeared to be quite unnecessary. In the ten years, the presence of an excess of ammonia (calculated on an average of three days' tests) had only been reported on four occasions; and three of these were cancelled on appeal. With regard to the presence of sulphuretted hydrogen, witness said he could see no reason why any alterations should be made, as the test prescribed by the Referees was less stringent than that applied to most of the gas burnt outside London, in which the test paper was used in a moist condition. The amount of sulphur compounds other than sulphuretted hydrogen which was allowed to be present, was considerable; and he saw no reason for increasing this quantity.

With respect to the injurious results arising from the presence of sulphur in the gas, witness drew attention to the corrosive effect of gas containing sulphur upon metal surfaces which were heated by the gas-flame. In the chemical laboratory, he had frequently found that the action of gas, even on copper vessels, was rapidly destructive when there was prolonged contact with a flame, and that the product of the action contained much sulphate. A report on "Leather for Bookbinding," made in 1901 by a Committee appointed by the Society for the Encouragement of Arts, Manufactures, and Commerce, stated that, "of the deleterious influence to which books are subjected, the fumes of burnt gas are the most fatal." The same conclusion was arrived at by Dr. J. Gordon Parker, who described an experimental test in a paper read before the Society of Arts in the same year. If gas was to be increasingly used for heating purposes, it would therefore appear that it should contain less, and not more, sulphur than it did at present.

Witness said that statements made "by interested parties," that London was the only city where restrictions were in force limiting the quantity of sulphur compounds other than sulphuretted hydrogen, were misleading. The total output of gas for England and Wales in the year 1901-2 was 140,634,393,059 cubic feet; and at least 60 per cent. of this was either under statutory obligations with regard to sulphur compounds or the sulphur was voluntarily kept within limits. In some Continental towns, the gas supply was required by statute to be free from a trace of sulphuretted hydrogen, and also to contain a limited amount only of sulphur compounds other than sulphuretted hydrogen.

The first point on which witness was questioned was the method of testing. He said he took distinct exception to the arrangement which Parliament adopted in the South Metropolitan Act of 1900, by which the gas was burned at the 16-candle rate. The 5 cubic feet per hour rate ought to be maintained; and the departure from it was not observed by the County Council, or it would have been opposed. Even now that Parliament had sanctioned the arrangement, a reversion to the original method of testing would be the only satisfactory plan. The Company obtained their Act somewhat under false pretences, because they did not explain that they were going down 3 candles of illuminating power, which they virtually were. The Chairman pointed out that they had it in evidence from Sir George Livesey that if the old method of testing had been insisted upon, he would have withdrawn the Bill; and he asked whether it would be fair now to go back upon this, and accept the proposals for a reduction of price, &c., but insist upon the method of testing which was rejected in the Act. Witness replied that he considered the only satisfactory way of testing was to define the rate of consumption. The Referees had stated that they were departing to some extent from this, and making a tabular correction that would allow for the slight departure; but they certainly intended their method to apply only to 16-candle gas, and it would have been revised by them if they had thought it was going to be applied to 14-candle gas. That was the understanding. Apparently Mr. Vernon Harcourt differed from him (witness), and considered that a fairer comparison could be made by burning the gas at the 16-candle rate. What was being done by the South Metropolitan Company may have been understood at the time by Mr. Vernon Harcourt; but it certainly was not by him (witness). The County Council still wished to get this clause in the South Metropolitan Act repealed, and had attempted to do so. They were told that there was to be a change of 2 candles in value; but when they came to look into the matter, they found it was 3 candles. He thought this third candle was gained in a way that was scarcely justifiable. Witness did not appreciate at all what had been done until he was informed by the Referees that there was a change made in the statutory method of testing.

Interrogated by Mr. King, witness said he would suggest that a uniform standard burner—the No. 1 "London" argand—should be

used for gas testing throughout the Metropolis, with the same chimney in each case. The gas should always be burnt at the rate of 5 cubic feet per hour; and, on the present table photometer, he should arrange this by shifting one of the sources of light. By testing in this way, the present South Metropolitan gas would be called 13-candle instead of 14-candle gas. Every one agreed that the difference was 1 candle—the Company were with them on this. It would therefore be fair to ask Parliament to impose on the Company the obligation of making the gas 1 candle better than they made it now, retaining all the provisions and restrictions which the Company were subject to under their Act. They professed to allow the consumer 1d. per candle; and as they again reduced the price 2d., they should bring their gas up to 14 candles.

Witness next dealt at length with the Council's portable photometer proposal, which was thoroughly gone into by Mr. Oldroyd's Committee. He said that, as the reult of experiments with this instrument, the only conclusion that Professor Frankland, himself, and others could come to was that there was certainly one quality of gas in the official testing-stations and another quality outside. In the case of one Company who were professedly supplying 16-candle gas, and kept over this in the testing-station, sometimes 12 candles were obtained by the portable photometer, and the results had been as low as 11 candles. The Council then asked that the Board of Trade should institute an inquiry into the possible cause of difference in these testings; and he supposed that the present Commitee had more or less taken over the task—this being the first inquiry since the Board of Trade were asked to go into the matter. He did not think these differences could be attributed to stagnation of gas in the mains at particular spots; but whatever the cause, he was satisfied that the consumers, in some places at any rate, were not receiving what they were entitled to. The proposal of the Council was to include the portable photometer tests among those for which the Companies were liable to forfeiture; but the rooms in which the tests were to be made should be approved by the Referees. They felt the absolute necessity of such tests. He did not know how Mr. Oldroyd's Committee arrived at their unfavourable decision regarding the instrument, because it seemed to all who had attended to the evidence that the Committee's views were in the other direction. Indeed, he (witness) was even congratulated in the Committee-room by some of the opponents on the fact that the Council had won their case.

Turning to another matter, witness said he complained that the Council had not sufficient control over the testing-stations. He was in agreement with the proposition of the Referees that there should be no tap by which the supply of gas could be cut off in the service-pipe; or that the tap should be kept under glass, so that it could be got at in case of emergency. Then it was absolutely necessary that the Council's officers should have a right at any time, and at all times, to go into the stations. Mr. King remarked that there had been a point raised (he thought it was still pending) with regard to the attachment of a tap or connection to the service-pipe from the large main in the street to the photometer. Suppose this was done away with, and the service-pipe was brought direct from the main close up to the table photometer, without any connection between the two points, would this remove the possibility of differences between the quality of the gas at the testing-station and in the district? Witness said he should think not. The Council would still wish to test in the district, after their long experience of variations.

The Chairman asked Dr. Clowes whether he had any general view as to the policy of reducing the illuminating power of gas. Witness answered that such a course was extremely hard on consumers who were using any other than incandescent burners. These burners, of course, gave more than sufficient light; but the flat-flame burner was very largely dependent upon the illuminating power of the gas, and certainly the vast majority of burners in the Metropolis were of this character. He did not think the Welsbach, in its present condition, would ever be the burner of the people. There were many circumstances under which the flat-flame must be retained as the popular burner, unless the mantles could be very much improved. Therefore, on the whole, he preferred a high candle power gas. The partial or total replacement of an illuminating test by a thermal test would not meet the case of the flat-flame burners at all, because it was possible to get gas of high calorific value and indifferent illuminating power. The Council, however, distinctly wished that there should be a measurement of calorific value as well as of illuminating power. Gas was used so largely for power and heating purposes now that the calorific test was of very great importance; and the double requirement would be of advantage to the Companies as well as to the consumers. The Chairman remarked that witness seemed to be in favour of piling up obligations on the Companies; but they must look at the matter a little from the point of view of the Companies too. He had been wondering whether some kind of joint test for calorific and illuminating value could not be devised, so as to allow one more or less to counterbalance the other.

Coming to the question of impurities, witness said he did not think the present test for sulphuretted hydrogen was unduly stringent. The methods of removal were quite simple and easy. He did not, however, see any serious objection to the test prescribed by the Gas-Works Clauses Act, 1871, if it was frequently repeated. In the case of sulphur compounds other than sulphuretted hydrogen, he also thought the existing test should be maintained. Of course, there had been a great deal of relaxation provided recently by the special prescription of the Referees. Taking the various statements made, it seemed to him that practically the only argument of the Companies for being freed from this test was the difficulty of disposal of the spent lime. Mr. Thomas Holgate had a process of treating the gas with the liquor obtained in the works themselves in closed vessels; and by this means apparently the sulphur compounds were reduced quite as satisfactorily as by lime. The process was described in a paper read by Mr. Holgate before the Institution of Gas Engineers, which was published in the "JOURNAL OF GAS LIGHTING" for May 28, 1895. With regard to the proposition to make the test relate, not to the maximum of sulphur as found on any particular day, but rather to the average over a considerable interval of time (for instance, a month), witness said he should have thought that the three days' average would be sufficient, as already prescribed by Parliament.

As to testing for illuminating power, Dr. Clowes said he would not have the slightest objection to the use of a flat-flame burner. Seeing that a variation of 1 candle in the lighting power of the gas supply of London was said to represent a cost of £300,000, any expense involved in testing the gas and ensuring that it should be up to its proper standard was well incurred. He did not admit that the financial interest of the consumer was provided for sufficiently by the sliding-scale arrangement. A certain amount was allowed, but what was recovered by him in this way in no sense corresponded with the value he lost in illuminating power. He (witness) valued a candle at something like 3d. or 4d.; and 2 candles he should reckon would mean about 8d. to the consumer. It should also be understood that the testing was of material help to the Companies, though it was spoken of as being only prejudicial to their interests. The Council had a very large number of complaints from consumers that they were being supplied with gas of insufficient illuminating power. The response the Council made was to at once send a portable photometer into the district; and they found in many cases that the gas was of a satisfactory character, and the consumer had no cause of complaint. The Council did not as a rule suggest to the consumers that their burners were probably at fault; they simply advised them of the results obtained.

Witness, in reply to the Chairman, agreed that the Chief Gas Examiner would be in a better position to assess penalties than a Magistrate. But the Council felt that publicity should continue to be given to the cases, which would not happen if they were heard by the Chief Examiner—unless he permitted the presence of reporters.

Dr. Clowes then handed in a report by the Chemist to the Council on the results of an examination made between June 1, 1901, and May 17, 1902, of the London Gas Supply as to the presence of water gas. This stated that 57 per cent. of the samples taken in the district supplied by the Gaslight and Coke Company contained under 12 per cent of carbonic oxide, and 94 per cent. under 16 per cent. Generally there was very little difference in the quantity of carbonic oxide present in the gas supplied by this Company to any one place on the same day; the percentage being about the same during lighting hours as out of lighting hours. Of the samples collected in the area supplied by the Commercial Gas Company, 19 per cent. contained less than 12 per cent. of carbonic oxide, and 76 per cent. less than 16 per cent. When two samples were collected at the same place on any one day in the district supplied by this Company, the percentage of carbonic oxide varied considerably; the larger quantity being generally present in the sample collected during the hours of lighting. The report went on to say: "The information obtained from an examination extending over a year proves that the Gas Companies are able to supply gas of the statutory illuminating power, even when the quantity of carbonic oxide in their gas does not exceed 12 per cent. I recommend therefore that if any of the Gas Companies who are supplying gas to London are using water gas, when the Board of Trade introduce a measure limiting the extent of the enrichment of coal gas by means of carburetted water gas, this Committee should seek to have inserted in the Bill a clause stating that the whole amount of carbonic oxide present in the gas, as it is supplied to London, shall not exceed at any time during the twenty-four hours 14 per cent. by volume." Witness pointed out that 14 per cent. by volume corresponded to 20 per cent. of carburetted water gas. This 14 per cent., of course, included the carbonic oxide that was originally present in the unenriched gas.

In conclusion, witness agreed that, in view of the high price and scarcity of cannel, carburetted water gas was practically the only means by which coal gas could be enriched. At any rate, from all the information he had obtained, he should say it was the only method available for a place like London, where the gas had to travel great distances from the point of manufacture before reaching the consumer. Over and over again, evidence had come before him to prove that carburetted water gas was capable of carrying enrichment for practically unlimited distances.

THE OMAGH GAS-WORKS PURCHASE.

The Arbitrator's Award to be Traversed.

At a Meeting of the Omagh Urban District Council on the 20th ult., a report was presented by the Gas Committee dealing with their proceedings with regard to the acquisition of the undertaking of the Gas Company. They reviewed the various features of these proceedings, as recorded in the "JOURNAL," down to the publication in May of the draft award by the Arbitrator (Mr. J. W. Edmundson, of Dublin), the amount of which was £26,880. He fixed Wednesday, the 22nd ult., as the date on which he would attend at the Court House, Omagh, for the purpose of hearing objections to his award, after which he would make his final award. The question the Committee submitted to the Council was whether it would be advisable to traverse the amount of the award. The report was adopted; and it was decided to consider the question just alluded to at a special meeting to be held for the purpose. Meanwhile, Mr. Edmundson attended at the Court House on the above-named day, when Mr. Dickie, on behalf of the Company, objected that the award did not contain any reference to book debts owing to the Company; and he urged that if the Council, in taking over the concern, wished to acquire them, it should be done by arbitration or otherwise. Mr. Shields, who appeared for the Council, stated that, according to his view of the Act of Parliament, the award included all book debts and the whole undertaking, except the shareholders' papers. He objected to the award as giving the Company too much, and mentioned a sum of £18,000, which he was afraid, however, he could not ask the Arbitrator to adopt. Mr. Edmundson promised to look into the matter of the book debts, and to expedite his final award. The Council held their special meeting on the 27th ult., when Mr. Shields told them that they could traverse the award, and insist on a trial before a jury. After a long discussion, it was unanimously resolved that, as the Council were of opinion that the award was excessive, it should be traversed, and that the Solicitor (Mr. Shields) be instructed to take the necessary steps for the purpose.

EDINBURGH AND LEITH GAS COMMISSIONERS.

The Working of the Undertaking for the Past Year.

As indicated in our last issue, the annual abstract of the accounts of the Edinburgh and Leith Gas Commission was laid on the table by the Treasurer (Mr. John S. Gibb) at a meeting of the Commissioners on Monday, the 27th ult. Accompanying the accounts, was the following statement by the Treasurer.

I have the honour of laying before you a copy—proof, subject to audit—of the abstract of the Commissioners' financial accounts for the year ended May 15 last. The usual course is to remit this abstract to the Finance and Law Committee for consideration and report.

The gross surplus on the year's working is		£79,470 13 3
There has been paid during the year—		
For Edinburgh and Leith annuities .	£32,002 13 3	
,, Edinburgh-Portobello annuities .	1,102 8 0	
,, Amount transferred to sinking fund in respect of annuities redeemed.	2,094 18 9	
,, Do. in respect of mortgages redeemed	636 18 0	
,, Interest on mortgages, &c. . . .	30,849 6 7	
,, Expenses of mortgages	220 13 1	
Together . . .		66,906 17 8
Showing a net balance on the year's working of . .		£12,563 15 7
The sum at the credit of profit and loss account is. .		£12,563 15 7
This is subject to the statutory minimum charges for the sinking funds, as follows:—		
(1) For repayment of money borrowed (20s. per cent.)	£9,520 17 8	
(2) For redemption of annuities (15s. per cent.)	7,000 9 8	
(3) For reserve fund (Commissioners' Gas Order, 1902, sec. 9), ¼ per cent. on £172,858 10s. 4d. . .	432 2 11	
Together . . .		16,953 10 3
From which the above sum of £12,563 15s. 7d. being deducted, leaves a balance of . . . . . at the debit of profit and loss, which has to be carried forward against next year.		£4,389 14 8

Thirty-three million cubic feet of gas have been sold beyond last year; but the revenue from gas is less by £17,800—resulting from the lowering of the price in October, 1903, by 3d. per 1000 cubic feet. About £5000 more has been received from residual products, from the larger quantity for sale, though the rates for tar were flat for most of the year.

The present value of 1d. per 1000 cubic feet of gas is £7555.

Lord Provost Sir ROBERT CRANSTON said that, instead of 33s., they only obtained 17s. for tar; and sulphate of ammonia had fallen to £1 less than at this time last year. If these two things had been at the same price, instead of a deficiency they would have had a small surplus. He understood there was no necessity for their clearing off the debit, because the increased sale of gas during the year, and possibly an advance in the prices of ammonia and tar, would clear off the debit of last year, and leave sufficient for next year's operations.

Mr. GIBB said that last year he was instructed particularly not to send out any copies of the accounts until they were submitted to the Commissioners. Would he be at liberty now to furnish the accounts to the Press?

Sir ROBERT CRANSTON: No; I should say not, because there might be a back-letter from the Auditor. The accounts are subject to audit. They will be given to the Press when audited.

The remit to the Finance and Law Committee was then agreed to.

NOTTINGHAM GAS SUPPLY.

The Annual Reports.

In their report for the year ending March 31 last, which has just been issued to the Council, the Nottingham Corporation Gas Committee state that the quantity of gas sold amounted to 1,987,325,700 cubic feet, against 1,880,026,700 cubic feet in the previous year, or an increase of 107,299,000 feet, or 5·71 per cent. The net profit, after deducting the sums required for interest, annuities, depreciation, sinking funds, and annuity redemption fund, is £42,342, or an increase of £6004. The Committee recommend that out of this amount £28,300 be paid to the Finance Committee, by order of the Council, in aid of the current expenditure of the municipal year; and that of the remaining £14,042, the reserve fund shall be credited with £4000, and the balance be for the present unappropriated. The successful result of the working has enabled the Committee since the close of the year to make a further reduction in the price of gas for all purposes other than power. Alterations to apparatus for the supply of gas from Basford are being carried out; and the cost is being charged to revenue. The work is now well advanced; and the Committee hope that, when completed, it will afford much more efficient control over the output from these works.

Appended to the report of the Committee is an abstract of the accounts for the year, and the report of the Engineer and General Manager (Mr. J. H. Brown), who states that the plant is in a good state. Over £45,000 was expended on repairs and maintenance during the past year. Alterations have been made at Eastcroft and Giltbrook, where very considerable improvement was brought about in the working during last winter; and when the present alterations are completed even better results are anticipated. A plant for the manufacture of cyanogen is now nearing completion. The increase in gas sold has been steadily maintained year by year, in face of the largely increased use of incandescent gas-burners and electricity, and notwithstanding a great general depression in trade. Mr. Brown says there is no doubt that a part of this increase is due to the greater use of gas for heating and power purposes; but in many cases where gas had previously been disconnected in favour of electricity, newer and more modern incandescent gas-burners have recently been installed. The welcomed adoption of incandescent burners in the public street-lamps is steadily progressing, and has already been the means of reducing the consumption of gas thereby by 6 per cent., and the receipts by about £1695. The number of gas engines, cookers, and fires in use has largely increased. The mild winter experienced did not tax the producing plant so severely as was anticipated; but with a severer season, the supply would be maintained with considerable difficulty. The capital employed per million cubic feet of gas sold has been further reduced; the figures for the past three years being £622, £582, and £551 respectively. During the year, 208,118 tons of coal were carbonized, yielding 2,117,118,000 cubic feet of gas, or 10,173 feet per ton of coal, as against 201,367 tons of coal carbonized in 1903, yielding 2,017,394,000 cubic feet of gas, or 10,018 feet per ton. An increase of 6751 tons of coal was thus carbonized, at an additional cost of £584 for wages, or 2s. 4·14d. per ton, as against 2s. 4·39d. in 1903, and 2s. 5·37d. per ton in 1902. This is the lowest figure on record in the history of the undertaking. The cost of purifying has been further considerably reduced by alterations in the method of working, and by the reduction in the outlay on manufacture of the purifying material at the Giltbrook chemical works. The cost of the material has been reduced by £1600, and that of labour by about £500. These two items have effected a saving of 25 per cent. in the total cost, which was £5783, as against £7824 for the previous year. During the year the receipts for tar products increased from 1s. 9·81d. to 2s. 0·98d. per ton of coal; and ammoniacal products yielded 1s. 8·48d., as against 1s. 6 67d. in the previous year. The increase in these two products was equivalent to a gain of over £5400. The receipts for coke also showed a satisfactory rise. Unaccounted-for gas exhibited a striking decrease—from 6·81 per cent. to 6·13 per cent., or equivalent to a saving of over 14¼ million cubic feet of gas. This improvement, coupled with the increase in gas made per ton of coal, effected an increase in the gas sold per ton from 9336 to 9549 cubic feet. The maximum day's consumption during the year was 9,894,000 cubic feet on Dec. 18. This figure is lower than the maximum day's consumption for the year ending March, 1902; but the maximum day's make was 9,340,000 cubic feet, on Jan. 1, 1904, the highest figure in the history of the undertaking. The greatest day's consumption exceeded the storage capacity of the gasholders by nearly 750,000 cubic feet. The receipts for gas show a gross reduction of £2614, though 107,299,000 cubic feet more was sold. The reduction in price has been equivalent to a concession to the consumers of £17,372. There are at present in use about 23,128 cooking-stoves, 11,365 gas-fires, and 590 gas-engines, besides a very large number of other appliances of almost every description. Of the 23,128 cookers, 9177 are rented from the department and 13,250 are supplied free with automatic meters.

Under the heading of manufacture of gas, the expenditure was as follows: Coals, £108,223; purification, £5783: salaries, £2558; wages for carbonizing, £24,405; and repairs and maintenance, £45,392. In 1903, the figures were: Coals, £120,780; purification, £7824; salaries, £2177; wages for carbonizing, £23,821; and repairs and maintenance, £40,298. The total expenditure was £254,425, or £1 4s. 5·4d. per ton of coal carbonized, and 2s. 6·72d. per 1000 cubic feet sold. In the previous twelve months, the total expenditure was £254,407, or £1 5s. 3·21d. per ton of coal carbonized, and 2s. 8·48d. per 1000 cubic feet of gas sold. The receipts from the sale of gas were £255,916, as against £258,530; while rentals of meters and stoves were £10,792, as compared with £10,260. Residual products realized £79,477, against £69,458. The total receipts were £351,462, or £1 13s. 9·3d. per ton of coal carbonized, and 3s. 6·44d. per 1000 cubic feet of gas sold. Twelve months ago, the figures were £343,548, £1 14s. 1·46d., and 3s. 7 86d. respectively.

LANCASTER CORPORATION GAS SUPPLY.

The Past Year's Working—Reduction in Price.

The Engineer and Manager of the Lancaster Corporation Gas-Works (Mr. Charles Armitage) has presented to the Gas Committee his report for the year ending the 25th of March. It shows that the total receipts, including bank interest, less commission, were £29,185, and that the expenditure was £20,145—leaving a gross profit of £9040, which has been carried to the net revenue account and disposed as follows: Interest on stock and mortgages, £3842; redemption fund, £1612; income-tax, £501; borough fund, £1250; and reserve fund, £1835. The last-named fund amounts to £12,096. During the year, £1612 was added to the redemption fund; making it, with interest accrued, £23,229. The receipts for gas were £15,450, a decrease of £1738; £1501 being due to reduction in price, and £237 to less consumption. There were 2368 prepayment meters fixed up to date, and the receipts for the past year amounted to £4001—being an increase of £154, notwithstanding the reduction of price. For public and private lamps the net receipts were £118; 14,472,422 cubic feet of gas being supplied to the public lamps free of charge, or equal to £1464. The apportionment of the average price received per 1000 cubic feet of gas sold (2s. 2·82d.) is as follows: Net cost of gas, 1s, 0·54d.; new mains, services, meters, and prepayment stoves, 2·72d.; interest on stock and mortgages, less interest from Banking Company, 5·13d.; redemption fund, 2·21d.; to borough fund, 1·71d.; to reserve fund, 2·51d. The average cost of coal was 12s. 11·19d. per ton, against 13s. 3·64d. in the preceding year. Coke contributed in return 5s. 5·30d., and products from tar and ammoniacal liquor 4s. 8·10d.; making a return for residual products of 10s. 1·40d. per ton of coal carbonized, or 78·22 per cent. of the cost of the coal. Products, on the whole, have slightly increased in price since Mr. Armitage's last report. The total quantity of gas sold in the last twelve months was 175,064,889 cubic feet—an increase of 1,942,589 cubic feet (1·12 per cent.).

The report came before the Town Council at their meeting on Wednesday, when Alderman Bowness, in moving the confirmation of

the minutes of the Gas Committee, remarked that they thought they were justified in reducing the price of gas to ordinary consumers by 3d. per 1000 cubic feet (bringing it down to 2s.). The price had now been lowered twice this year, and the Committee had still maintained their position exceedingly well. There were one or two reasons for the course they had adopted. The price of coal had decreased, and they hoped that during the ensuing year the new stoker would be in active operation. They expected to derive considerable profit from its use; and there was no ground for fearing that their income would be considerably lessened by the reduction. The Mayor (Colonel Allen), in seconding the motion, said the estimated surplus for the year 1903, terminating on March 25, 1904, was £1521; and instead of this they had an actual surplus of £3084. Of this sum, £1250 went to the borough fund in relief of the rates, and the balance of £1834 was carried to the reserve. In addition to this, £1464 was given free for public lighting. The estimated surplus for the year ending March, 1905, was £1963; but the Committee felt that the reduction of 3d per 1000 cubic feet to ordinary consumers—involving £1684—would be about covered by the labour-saving machinery and the decreased cost of coal. The more favourable contracts for coal meant a difference of about £600, and the machinery would effect a reduction of something like £1000. The Committee would continue to supply gas for the public lamps free; and the amount would be about the same as last year. Of course, they hoped the lower price of gas would mean increased consumption; but there was no doubt that to reduce the price twice within twelve months was very good work. The minutes were passed.

NEW PLANT FOR WIGAN.

Last week Mr. R. H. Bicknell, on behalf of the Local Government Board, held an inquiry at Wigan into an application by the Town Council to borrow £45,870 for the purposes of their gas undertaking—£35,294 for new works, and £10,576 to repay money already overspent. Mr. J. Timmins, the Gas Engineer and Manager, said the application might be roughly divided under two heads—works for facilitating the production of gas, and works for facilitating the supply. The first were necessary for two reasons—economy, and making the labour in the retort-house of a more humane character. Stoking machinery would cost £6462, which with boilers, foundations, &c., would bring the amount under this head to £9942, or with 10 per cent. for contingencies to £10,936. This would not permit of any more gas being made than at present; but a new lift to one of the holders (£5600) would add a million cubic feet to the storage capacity. By the stoking machinery, the cost of production would be reduced by 9d. or 10d. per ton of coal carbonized. A sum of £650 (half of which had already been spent) was put down for an experimental gas-works, to allow of the testing of coals and residuals; and there was an item for six railway trucks, as to which the Inspector appeared to entertain some doubts. For ordinary meters £4200 was required, and for prepayment meters £4800; while £500 was put down for sidings extension, and £1600 for a duplication of the sulphate plant. Mr. Timmins stated that since 1887 the consumers had increased from 5298 to 15,340; while during the same period the profits had totalled £150,000, or an average of £9397. The make of gas had increased from 236 to 425 million cubic feet; and not only had there been a substantial reduction in price, but meter-rents had been abolished. During the last two years, also, gas had been supplied free for the public lamps.

Mr. A. E. Stoker, a ratepayer, said the total expenditure on the gas undertaking was £346,220. The point he wished to make was that the consumers paid the interest on the £10,000 overspent; while the gas Committee had handed over to the general district rate £11,800, besides spending £3984 on lighting the streets. This all came from the consumers, who had absolutely to assist to pay the district rate of people who did not burn gas themselves. If the profits in the past had been applied as a reserve fund, it would not now be necessary to raise a loan, on which the consumers would have to pay interest. He did not object to the money asked for that day being spent, but it ought to be spent by the people who derived benefit from it. The Inspector remarked that the policy of the Corporation had nothing whatever to do with the inquiry; but he allowed Mr. Stoker to proceed because possibly this was the only opportunity he had of making his point. The Corporation had a perfect right to manipulate—if he might use the term—their accounts as they liked. They might give from one department to another department; and they were quite free to give any money made to a department that was losing. The ratepayers had the power to turn out the Corporation if they did not like their policy. The Town Clerk said there was no power to establish a reserve fund.

OLDBURY GAS UNDERTAKING.

Large Reduction in Price to Power Users.

At the Meeting of the Oldbury District Council on Friday, the Gas Committee reported that they had decided to reduce the price of gas 1d. per 1000 cubic feet to ordinary consumers, and 4d. per 1000 cubic feet to power users; these reductions to take effect after the reading of the meters for the June quarter. In moving the adoption of the report, some figures from which were given in the "JOURNAL" last week (p. 980), Mr. C. Tomlinson said the Council had a great deal to congratulate themselves upon in connection with the working of the gas undertaking during the past year. The revenue account, compared with the preceding year, showed an enormous profit; but this was the result of fifteen instead of twelve months' trading, and ought to be reduced by at least one-fifth. The Committee had decided to make a considerable concession in the price of gas, and the recommendation they now submitted would mean a reduction of about £730 in the gross profits of the undertaking next year. In addition to this, they intended to hand over £600 in relief of the rates; and they hoped to do the same again. They were making this reduction in the expectation of stimulating an increased demand for gas, more especially for motive power; and one of the reasons for it was that they would be able to buy coal cheaper in the coming year than they did twelve months ago The gas supplied for power purposes in the Oldbury district for the past year was 14,465,000 cubic feet; but the Committee felt that the reduction would be the means of increasing the consumption and encourage small manufacturers to use gas instead of steam engines. He complimented Mr. Cooke upon his capable management of the gas-works, and thanked him for the great interest he always manifested in the welfare of the undertaking. The action of the Committee was then approved.

To the figures given last week we are now able to add the following: Coal gas made, 146,479,000 cubic feet; water gas made, 9,001,000 cubic feet—together, 155,480,000 cubic feet. Gas sold for private lighting, 119,721,000 cubic feet; for public lighting, 17,279,000 cubic feet; used on works, &c., 3,300,000 cubic feet—total, 140,300,000 cubic feet, leaving 15,180,000 cubic feet, or 9·76 per cent., unaccounted for. The following figures relate to manufacturing operations: Gas made per ton of coal (20 cwt), 11,579 cubic feet; sold, 10,908 cubic feet; coke and breeze made, 7662 tons 10 cwt. 2 qrs., or 12 cwt. 2 qrs. 14 lbs. per ton of coal carbonized, of which 10 cwt. 2 qrs. 17 lbs. were sold; coke used for fuel (including carburetted water-gas making), 1053 tons 11 cwt. 3 qrs, or 2 cwt. 1 qr. 27 lbs. per ton of coal; tar made, 146,409 gallons, or 12·16 gallons per ton of coal; ammoniacal liquor produced, 274,635 gallons, or 22·82 gallons (11 oz.) per ton.

SANDWICH CORPORATION GAS SUPPLY.

According to the statement of accounts of the Gas Department of the Sandwich Corporation (of which Mr. T. Ebenezer Pye is Engineer and Manager), presented to the Town Council by the Official Auditor of the department, the total income from the sale of gas in the year ending the 31st of March last was £2556, of which £295 was from slot meters. Residuals and sundries produced £474; making a total of £3030, against £2942 and £2847 in the two preceding years. The total works cost was £1811, against £1896 in 1903 and £2305 in 1902. The total sale of gas, by collection rentals was 11,314,200 cubic feet, compared with 11,105,300 cubic feet in 1903 and 10,106,200 cubic feet in 1902. The make per ton was 10,650 cubic feet, against 9920 and 9150. The net cost at the works (less residuals) per 1000 cubic feet of gas sold last year was 2s. 9d.; in 1903, it was 2s. 10d.; and in 1902, 3s. 10½d. The profit earned in the past financial year, as shown by the revenue account, was £672. In the year 1902-3, it was £675; but in the preceding year there was a debit balance of £240. The price is now 4s. 7d. and 2s. 10d. to ordinary, and 5s. to prepayment consumers, against 5s., 3s. 10d., and 6s. before.

LAMPETER CORPORATION AND THE GAS COMPANY.

Board of Trade Inquiry Requested.

By direction of the Mayor and Corporation of Lampeter, the Town Clerk (Mr. J. Ernest Lloyd) has addressed a letter to the Board of Trade, asking them to institute an inquiry into the management of the Lampeter, Llandyssil, Tregaron, and Aberayron Gas Company. It is complained that though the Act under which the Company was constituted provides for the holding of two ordinary meetings a year and the retirement of half of the Directors at the first of these meetings, and defines the qualification of a Director to be the possessor in his own right of not less than ten shares, all these provisions have been violated. It is asserted that until May last no meeting of the shareholders had been held for many years, that the Directors had not retired, and that the Chairman did not possess any shares in his own right. Further complaint is made that for a long time the Company disobeyed the section of the Act which provides that they shall, within five years after commencing the supply of gas, reduce the maximum price to 6s. 3d. per 1000 cubic feet; the figure remaining at 6s. 6d. till November, 1896, and being now at the high rate of 6s. The pressure is stated to be unsatisfactory, to the great inconvenience of the consumers. In view of this condition of affairs, the Corporation considered the advisability of acquiring the Company's property; and they offered £1000 for the works, goodwill, &c. This offer brought the shareholders together—for the first time, as it is stated, for many years—and a resolution was passed declining the offer as being far below the amount the Directors had been informed was the fair value of the property, which had been put by the Company's adviser (Mr. Henry Woodall) at £3300. The Corporation submit specifically: (1) That in three cardinal points—the meetings of shareholders, the retirement of Directors, and a qualification for a seat on the Board—the Company have persistently for many years violated the Act of Parliament under which they were constituted. (2) That there is an apparent discrepancy between the published accounts of the Company and the statement of their Secretary and of their adviser which calls for investigation. They also submit generally that the policy of the Company has been prejudicial to the interests of the borough of Lampeter; that the existence of the Company has prevented, and is preventing, the adoption of measures which would probably result in the more satisfactory lighting of the borough; and consequently they have not that claim to condonation of any violations of the law which might be founded upon the performance of valuable public services.

Part III. of "A Techniological and Scientific Dictionary" (published by George Newnes, Limited) is to hand—edited by Mr. C. F. Goodchild, B.A., and Mr. C. F. Tweney. It deals with subjects under the initial syllables of "Cop" and "Ele."

NEW SHOW-ROOMS AT WALTHAMSTOW.

The Lea Bridge District Gas Company, having some two or three years ago found that with a show-room at the works they were not able to get sufficiently in touch with the general body of their consumers, opened as an experiment a small place at Walthamstow, for the display of burners, fittings, cookers, &c. In view, however, of the up-to-date methods adopted by the Company for the securing of business, it was soon found that these premises were too small; and therefore more commodious show-rooms have been secured, so as to adequately cater for the wants of consumers in this part of the Company's district.

These are situated in High Street, Walthamstow, just opposite the smaller building which they have superseded. The glass frontage for the display of goods is 80 feet long; the outside being lighted by a number of high-power incandescent lamps of various designs and makes, and suitable for all kinds of exterior shop lighting. In the basement there is a large fitters' shop, adjoining which is the pipe and iron fitting store; while on the first and second floors are stock-rooms for various classes of goods. On the top floor resides the Company's Out-Door Inspector. Telephonic connection by a private line exists between the offices of the Engineer (Mr. F. W. Cross) and the show-rooms; and at night time an extension is made at both ends, so that the foreman's offices at the works is in direct communication with the Inspector.

In connection with this event, it is interesting to note the history of gas lighting in Walthamstow. The district was first supplied with gas in 1856 by a private Company. Later on, a rival Company came into the field; but the area was found too small to support both, and in 1868 the Lea Bridge District Gas Company was formed to take over both the other Companies. The growth of business was gradual until 1895; but in 1896 there was a "boom" in the development of the district. With this, the business of the Gas Company rapidly advanced, and has continued to do so to the present day. In 1895, the output of gas was 86 million cubic feet; whereas in 1903 it had increased to 203 million cubic feet. The total number of ordinary meters in use in the former year was 1350; the number at the present time is 3850. The length of mains in the Company's district in 1895 was 38 miles; while at present the total is nearly 80 miles. In May, 1901, the Company started to fix slot meters; and the number now in use is 2120. The total number of cookers in use in in 1895 was 160; while there are now in use 3330, including 2000 slot cookers.

Messrs. Robert Dempster and Sons, Limited, of Elland, have received an order from the Rhymney and Aber Valley Gas and Water Company for a steel tank 83 ft. 6 in. diameter and 24 ft. 6 in. deep, and a single-lift gasholder, prepared for telescoping, complete with all foundations. The work has to be finished in 4½ months from date of the order, and carried out under the supervision of Mr. A. R. Cawley, the Company's Engineer.

INCANDESCENT GAS LIGHTING v. ELECTRICITY.

A Splendid Testimony.

What is known as the "Mirus" Bazaar was held in Dublin from May 31 to June 4, and one of the things that contributed to its success was the lighting by high-pressure incandescent gas-lamps. The Alliance and Dublin Consumers' Gas Company saw their opportunity in connection with this matter; and by their work they made an almost startling contrast with the electric light. The result has been a splendid advertisement in Dublin for gas. The following copy of a letter received by Mr. Francis T. Cotton, the Secretary and Manager of the Company, needs no comment:—

Mercer's Hospital, Dublin, June 28, 1904.

Dear Sir,—The Committee of "Mirus" Bazaar desire us to convey to you their appreciation of the excellent arrangements made by your Company for the lighting of various sections of the Bazaar by means of the incandescent system of gas lighting, which we were induced to adopt on account of the electric lighting failing to give sufficiently brilliant illumination in parts of the building. We beg to thank you for the prompt manner in which your Company assisted us, and to inform you that the incandescent gas lighting was a great success, and has, in our opinion, proved a valuable factor in connection with the success of the Bazaar. We would like specialiy to mention the name of Michael Byrne, your Foreman in charge of the work, for commendation.—We are, yours truly, A. H. COURTENAY (Col.), RICHARD DOWSE, R. CHAS. B. MAUNSELL, W. I. DE C. WHEELER, SETON PRINGLE, Honorary Secretaries to the Bazaar.

INCANDESCENT LIGHTING IN AMERICA.

From a recent issue of a New York contemporary, it is learnt that Commissioner Oakley, of the Department of Water Supply, Gas, and Electricity, was about to recommend to the Board of Estimate and Apportionment that every open flame gas-lamp in the two boroughs of Manhattan and Bronx (except fire signal lamps) should be changed to Welsbach mantle lamps. This will raise the total number of mantle lamps in Manhattan and Bronx to 22,500, and so will reach the minimum of $24·75 fixed in the Consolidated Gas Company's bid, if that number of mantle lamps should be authorized. At the present time the city is using between 5000 and 6000 mantle lamps and fully 19,000 open-flame lamps. Under the $24·75 bid of the Consolidated Company, the Company will have to stand all the expenses of repairs and maintenance, with the exception of keeping the posts themselves straight. Under the figures submitted by the Company, with the increased number of mantle lamps, the city will be put to an expense of $56,170 dollars more for the current year than with the lamps as now existing, basing the figures on the number of

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 21.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 14	10½	Alliance & Dublin 10 p.c.	20–21	..	5 0 0
100,000	10	,,	7½	Do. 7 p.c.	13–14	..	5 7 2
200,000	5	May 12	6½	Bombay, Ltd.	6–6½	..	5 4 0
140,000	5	,,	6½	Do. New, £4 paid	4¾–5¼	..	4 18 11
380,000	Stk.	Feb. 25	12	Brentford Consolidated	242–247	..	4 17 2
300,000	,,	,,	9	Do. New	182–187	..	4 16 3
50,000	,,	,,	5	Do. 5 p.c. Pref.	127–132	..	3 15 9
206,250	,,	June 10	4	Do. 4 p.c. Deb.	102–105	..	3 16 2
220,000	Stk.	Mar. 10	10¾	Brighton & Hove Orig.	212–217	..	4 19 1
246,320	,,	,,	7½	Do. A. Ord. Stk.	150–155	..	5 0 0
460,000	20	Apl. 14	10	British	38½–39½	..	5 1 3
100,000	Stk.	Feb. 25	6	Bromley, Ord, 5 p.c.	116–120	..	5 0 0
165,700	,,	,,	4½	Do. do. 3½ p.c.	89–93	..	4 16 9
500,000	10	May 12	7	Buenos Ayres (New) Ltd	10¾–11¼	..	6 4 5
250,000	Stk.	June 29	4	Do. 4 p.c. Deb.	92–94*	..	4 5 1
150,000	20	Mar. 10	8½	Cagliari, Ltd.	21–23	..	7 3 6
100,000	10	May 27	10	Cape Town & Dis., Ltd.	14–15	..	6 13 4
50,000	50	May 3	6	Do. 6 p.c. 1st Mort.	51–53	..	5 13 2
1,375,000	Stk.	Feb. 25	5⅝	Commercial 4 p.c. Stk.	110–114	..	4 11 3
536,485	,,	,,	5	Do. 3½ p.c. do.	106–109	..	4 11 9
442,947	,,	June 10	3	Do. 3 p.c. Deb. do.	85–87	..	3 9 0
800,000	Stk.	June 10	7	Continental Union, Ltd.	110–115	−2	6 1 9
200,000	,,	,,	7	Do. 7 p.c. Pref.	142–147	..	4 15 3
575,000	Stk.	Feb. 25	5⅛	Crystal Palace Ord. 5 p.c.	118–123	..	4 6 8
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–125	..	4 0 0
112,533	,,	Jan. 14	5	Do. 5 p.c. Deb. Stk.	135–140	..	3 11 5
486,090	10	Jan. 28	11†	European, Ltd.	19–20	+½	5 10 0
354,060	10	,,	11†	Do. £7 10s. paid	13½–14½	..	5 13 10
15,243,200	Stk.	Feb. 11	4⅛	Gas-light and Coke: 4 p.c. Ord.	93–95	+1	4 12 7
2,600,000	,,	,,	3⅜	Gas-light and Coke: 3½ p.c. max.	89–91	..	3 16 11
3,799,735	,,	,,	4	Gas-light and Coke: 4 p.c. Con. Pref.	108–111	..	3 12 1
4,193,975	,,	June 29	3	Gas-light and Coke: 3 p.c. Con. Deb.	88–90*	+⅛	3 6 8
258,740	Stk.	Mar. 10	5	Hastings & St. L. 3½ p.c.	90–95	..	5 5 3
70,000	10	Apl. 28	11	Hongkong & China, Ltd.	15–16	..	6 17 6
3,800,000	Stk.	May 12	10	Imperial Continental	202–205	..	4 17 7
473,600	Stk.	Feb. 11	3½	Do. 3½ p.c. Deb. Red.	97–99	..	3 10 8
165,242	Stk.	Mar. 10	6	Lea Bridge Ord. 5 p.c.	113–118	..	5 1 8
561,000	Stk.	Feb. 25	10	Liverpool United A	215–216	..	4 12 7
718,100	,,	,,	7	Do. do. B	159–161	..	4 6 11
306,083	,,	Dec. 30	4	Do. do. Deb. Stk.	108–110	..	3 12 9
75,000	5	June 29	5	Malta & Medn., Ltd.	4–4½*	..	5 11 1
560,000	100	Apl. 5	5	Met. of 5 p.c. Deb.	102–105	+2	4 15 3
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	103–102	..	4 8 3
541,920	20	May 27	3½	Monte Video, Ltd.	9–10	..	7 0 0
1,515,892	Stk.	Feb. 26	4½	Newc'tle & G'tesh'd Con.	105–107	..	4 4 1
406,025	Stk.	Dec. 31	3½	Do. 3½ p.c. Deb.	93½–94½	..	3 14 1
300,000	Stk.	May 12	8	Oriental, Ltd.	138–143	..	5 11 11
600,000	5	Mar. 29	7	Ottoman, Ltd.	5½–6½	..	5 12 0
					* Ex div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
235,005	Stk.	—	6½	Ply'mth & St'house 5 p.c	—	..	—
851,070	10	Apl. 28	7	River Plate Ord.	10¾–11¼	..	6 4 5
300,000	Stk.	June 29	4	Do. 4 p.c. Deb.	93–95*	..	4 4 3
250,000	10	Mar. 29	7	San Paulo, Ltd.	10⅜–11⅛	..	6 1 9
135,000	Stk.	Mar. 10	10	Sheffield A	237–239	..	4 3 8
209,984	,,	,,	10	Do. B	236–238	..	4 4 0
523,498	,,	,,	10	Do. C	234–236	..	4 4 9
116,106	Stk.	—	5	Shrewsbury Ord. 5 p.c.	—	..	4 10 11
6,150,000	Stk.	Feb. 11	5¾	South Met., 4 p.c. Ord.	125–127	..	4 3 11
1,832,700	,,	Jan. 14	3	Do. 3 p.c. Deb.	89–91	..	3 5 11
380,940	Stk.	May 12	5	Southampton Ord.	105–110	..	4 10 11
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Feb. 25	6	Tottenham and Edmonton: A. 5 p.c.	122–125	..	4 16 0
313,020	,,	,,	4½	Tottenham and Edmonton: B. 3½ p.c.	97–102	..	4 8 3
182,380	10	June 10	8	Tuscan, Ltd.	8¼–8⅝	..	9 2 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	96–98*	+1½	5 2 0
745,872	Stk.	Mar. 10	5	West Ham, 5 p.c. Ord.	97–102	..	4 18 0
				WATER COMPANIES.			
782,322	Stk.	June 29	12	Chelsea, Ord.	360–370*	..	3 4 10
150,000	,,	,,	5	Do. 5 p.c. Pref.	157–162*	..	3 1 9
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	142–147*	..	3 1 3
175,785	,,	Mar. 29	4½	Do. 4½ p.c. Deb.	137–142	..	3 3 5
1,720,560	Stk.	Mar. 29	8	East London, Ord.	225–230	..	3 9 7
654,740	,,	June 29	4½	Do. 4½ p.c. Deb.	135–140*	..	3 4 4
1,524,288	,,	,,	3	Do. 3 p.c. Deb.	91–94*	+1½	3 3 10
700,000	50	June 10	12	Grand Junction: 10 p.c. max.	137–142	..	4 4 6
310,000	Stk.	Mar. 29	4	Grand Junction: 4 p.c. Deb.	122–126	..	3 3 6
708,000	Stk.	Feb. 25	10	Kent	325–335	..	2 19 8
160,000	,,	,,	7	Do. New, 7 p.c. max.	230–240	..	2 18 4
1,043,800	100	June 29	11	Lambeth, 10 p.c. max.	320–325*	..	3 7 8
406,200	100	,,	8½	Do. 7½ p.c. max.	235–240*	..	3 10 10
350,000	Stk.	Mar. 29	4	Do. 4 p.c. Deb.	120–125	..	3 4 0
500,000	100	Feb. 25	10	New River, New Shares	385–395	..	2 10 8
1,000,000	Stk.	Jan. 28	4	Do. 4 p.c. Deb.	122–126	..	3 3 6
902,300	Stk.	June 29	7½	South-wark and Vauxhall: Ord.	280–285*	..	2 12 7
126,500	100	,,	7½	South-wark and Vauxhall: 7½ p.c. max.	220–230*	..	3 5 3
489,200	Stk.	,,	5	South-wark and Vauxhall: 5 p.c. Pref.	145–150*	..	3 6 8
1,019,585	,,	Mar 29	4	South-wark and Vauxhall: 4 p.c. A Deb.	115–120	..	3 6 8
1,155,066	Stk.	May 27	10	West Middlesex	303–308	..	3 4 10
200,000	,,	June 10	4½	Do. 4½ p.c. Deb.	137–142*	..	3 3 5
200,000	,,	Mar. 10	3	Do. 3 p.c. Deb.	91–94	..	3 3 10
					* Ex div.		

† Next dividend will be at this rate.

lamps in use on April 1. For the year 1905, the change will mean an increased expense to the city of $125,000. With the mantle lamps, however, the Commissioner's figures greatly added benefits to the city, besides the reduction of the cost for mantle lamps to $24·75 from $20. In the first place the mantle lamps will give 60 candle power as against 12 candle power each for the open-flame lamps. According to Commissioner Oakley the city has not made any advance in street lighting as far as the great majority of the streets are concerned, since 1823. The present side-street lights are a disgrace, and with the mantle lamps the streets of the east and west sides, especially near the rivers, will be greatly improved, and crime will be prevented in many instances.

THE PIPING OF HOUSES FOR GAS SUPPLY.

American Regulations for Builders.

The Public Service Corporation of New Jersey have issued the following set of regulations for building owners who intend to pipe houses for gas. Taken in conjunction with those issued by the Gas Company, they should lead to good work being done.

1.—The regulations of the company require that the piping in all new buildings shall be strictly in accordance with the terms embodied in their suggestions to pipers, a copy of which may be secured at the gas office.

2.—A strict adherence to these regulations is necessary in order to ensure the piping being properly put in and of proper capacity; and, therefore, these regulations operate greatly to the advantage of the owner, even if also to the gas company's advantage.

3.—When contracting for the gas-piping, stipulate in the contract that, before payment for the piping shall be made, a certificate of inspection from the gas company shall be secured.

4.—It will be noticed that no greater length of pipe of each size is allowed than that specified in the text, and that no more burners can be taken from any size than the number stated, even if the length of pipe is diminished.

5.—Meters shall not be placed in any room or basement that is not wholly under the control of the consumer.

6.—In all cases the position of the meter shall be determined by our inspector.

7.—Our inspector cannot be expected to answer a call for inspection unless 24 hours' notice is given, and he has made an appointment for a specified hour, when such specified hour is desirable.

8.—All service-pipes and other connections between street mains and meters, passing through arches, under sidewalks, coal-holes, or areas, and all other pipes in exposed places, must be protected from accident and the weather at the expense of the party for whose benefit the gas is supplied.

9.—Care must be taken to avoid crossing the gas-pipes with electric wires, as buildings so piped will not be passed by the inspector.

10.—No job will be approved where "gas-fitter's" cement has been used as a material to stop sand-holes or other leaks, or for any other purpose.

11.—No person shall disconnect or remove any gas-meter, except the duly authorized representative of the gas company.

12.—The company make no charge for inspection.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The statement submitted by the Treasurer of the Edinburgh and Leith Gas Commissioners at their meeting on Monday shows that there is a debit balance for the past year of £4389, which has been brought about by the reduction in the price of gas last October by 3d. per 1000 cubic feet; also that 33 million cubic feet more gas was sold than in the previous year. Twelve months ago, it was reported that the increase in the sale of gas was 30 million cubic feet; and that there was a credit balance, notwithstanding the price of gas had been reduced by 4d. per 1000 cubic feet, of £4759. The difference between the two years lay in this, that in the one year there was an increase of £15,500 in the amount derived from residual products, along with a decrease of £20,000 in the cost of coal, oil, and other manufacturing charges, and that in the period just closed the only gain of consequence was one of £5000 for residual products, due to the greater quantity for sale—that is to say, that savings from the new works at Granton were not in evidence last year, because they were estimated for, whereas they told in the year preceding. This reduces the deficit to a mere matter of accounting; and it is satisfactory to know that, with an ordinary overturn, it will be easily wiped out in the current year.

The Commissioners also had before them letters from the South Side Merchants' Association and George Square Ward Ratepayers' Association, upon the subject of municipal trading—objecting, of course, to the Commissioners' dealing in gas-stoves. They asked that a deputation should be heard upon the matter; and it was agreed to hear the views of the traders in October. Bailie Douglas moved that it be remitted to a Committee "to consider and report upon the necessity for, and also the working expenses of, show-rooms and offices for the sale of gas-cookers, gas-fires, and other gas appliances; the report to contain a detailed statement of the number of such appliances bought each year from 1895 to 1904 (ten years), also the numbers sold, hired, and in stock at the date of the report, with a detailed note of the expenditure in fitting up, and the revenue derived therefrom, each year." The

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subject was remitted to the Works Committee, as was also a memorandum by Mr. Herring upon the subject of trading, which surely forms the most complete answer that could be provided to the objections of the traders.* The traders forget that they are in a different position from the Commissioners. They do not hire out gas appliances, but sell them; and the Sale of Goods Act comes into force at once with them. If an article does not please, that is no affair of theirs. The customer may throw it out if he likes; and if he does so, the result is that a consumer is lost to the Gas Commissioners. The Commissioners go behind the Sale of Goods Act, and seek to please their customers, although it may be at a loss to themselves for the time being; but in so doing they retain the gas consumers. If the traders would undertake that duty, there is no doubt that the Commissioners would leave the field open to them. The weakness of the traders' position is seen in this, that, while they postulate upon there being 500 of them, the Commissioners' return for the year from gas appliances was only £1200. Suppose a third more were added for profit, the total amount would only be £1600—and the proportion to each of the 500 would only be a little over £3—that is, of revenue, not of profit.

The annual meeting of the Hawick Gaslight Company was held yesterday afternoon. The Chairman—Mr. R. Noble—said it was very gratifying to be able to put such a favourable report before them, and to be in a position to make a further reduction in price. At 2s. 8½d. per 1000 cubic feet, the price was the lowest at which gas had ever been sold in Hawick. On prepayment meters they also proposed making a reduction of another penny in the shilling. By the sale of secondary products, they obtain more than enough to pay their dividend. The Directors held their last meeting at the works, and found everything in perfect order. They considered that great credit was due to the Managers for the successful result of the year's trading. The report was adopted. The quantity of gas sold during the year was 66,008,100 cubic feet.

The Directors of the Galashiels Gaslight Company report that the profit for the past year amounted to £2278, which, with a reserve of £6054, makes £8332, from which they propose to pay a dividend at the rate of 10 per cent.; to pay £100 honorarium to the late Manager; and to carry to reserve fund £6132. The quantity of gas manufactured during the year was 59,340,000 cubic feet, compared with 57,800,000 feet in the preceding year. The Directors have considered the subject of a reduction in the illuminating power of the gas. They have found that there have been reductions all over the country; and they have resolved, in view of the great extension of incandescent gas lighting, and the increased demand for gas for other purposes, that in future they will supply gas of 25-candle power. They also propose to reduce the price from 3s. 4d. to 2s. 11d. per 1000 cubic feet.

The accounts of the Perth Corporation Gas Department are under audit by Mr. R. F. Cameron, of Inverness. They show a revenue of £34,350, and an expenditure of £23,930; leaving a gross surplus of £10,420. It is said that Mr. Cameron has taken exception to the disposal of the surplus, holding that sufficient has not been written off for depreciation of gas-stoves, and that the gas contingency fund has not been separately invested.

The Auchterarder Gas Company have paid a dividend at the rate of 5 per cent. for the past year. The annual meeting of the Kelso Gas Company was held on Wednesday. A dividend at the rate of 10 per cent. was declared; and it was agreed to reduce the price of gas from 3s. 9d. to 3s. 4d. per 1000 cubic feet. The Directors of the Linlithgow Gas Company have, in consequence of the reduction in the price of coal, and the benefits derived from the introduction of new and improved plant, reduced the price of gas from 3s. 9d. to 3s. 4d. per 1000 cubic feet.

The Town Council of Dundee met as Water Commissioners yesterday and considered the accounts and estimates which had been prepared by the Water and Finance Committee jointly. There was a deficiency last year of £870. For the current year, the revenue is estimated at £51,770; and there is an anticipated surplus of £110.

A statement is published this week which seems to indicate that the capital account of municipal electric light undertakings is not regarded by the central authorities as on a quite satisfactory basis. It says: "A special meeting of the Bo'ness Town Council was held on Wednesday night—Provost Stewart presiding—to hear read the letter received from the Scottish Secretary (Mr. Graham Murray) consenting, after a great deal of representation, to the Town Council borrowing £25,000 to defray the cost of introducing an installation for the lighting of the burgh by electricity. Mr. Graham Murray, in consenting, issues a warning note that his decision at this time is not to be regarded as constituting a precedent; the whole proceedings, he says, in reference to cases where, as in the Bo'ness case, working agreements have been entered into under section 11 of the Electric Lighting Act of 1882, being under review. Ex-Provost Ballantine was evidently not clear about the meaning of the last clause in the Secretary's letter, and the Provost informed him that it meant that if any Town Council happened to apply to the Scottish Office for a similar certificate to borrow, they would run the risk of a refusal until the whole matter of borrowing under section 11 of the Act had been thoroughly thrashed out. It was agreed to abandon the special scheme adopted for lighting the Town Hall, Library, and Hospital, and entrust the lighting rather to the National Construction Company, now that power to borrow has been got."

At the annual *conversazione* of the Society of Arts in the gardens of the Royal Botanic Society, Regent's Park, on Monday evening last week, the Kitson light was used in a portion of the grounds; a marquee containing a beautiful display of growing and cut roses and other flowers, by Messrs. William Paul and Sons, of Waltham Cross, being effectively illuminated.

* The memorandum referred to is unavoidably held over till next week.—ED. J.G.L.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.)	1,800,000
		ACCRINGTON	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND, IN ADDITION, 3,000,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 2.

Sulphate of Ammonia.

June requirements being covered, the market has assumed a quieter tone; but quotations remain at the highest points—£11 18s. 9d. to £12 per ton f.o.b. Hull and Liverpool, and £12 2s. 6d. per ton f.o.b. Leith. The Continent remains quite indifferent, and Spanish buyers are scarcely yet in line with the recent advance; but, on the other hand, production is at its minimum, and there are no important stocks to bring forward into the second half of the year. There are speculative contracts to cover; but the course of the market in July seems likely to be largely determined by the extent of Colonial requirements. In the forward position, London and Scotch makers maintain their firm attitude, but without effecting sales; while speculators are again offering near months at the level of spot prices. Consumers, however, are more concerned with later months; but their views are too low to admit of much actual business.

Nitrate of Soda.

The spring demand for this article being over, the extreme prices recently current on the Continent are no longer obtainable, and local quotations are reduced to 9s. 9d. and 10s. per cwt., according to quality.

LONDON, *July* 1.

Tar Products.

There is really little to record; and business has been very quiet all round. Pitch is decidedly dull. It is reported that makers on the east coast have accepted 31s. per ton in one or two instances for early delivery; but as a rule they ask 31s. 6d. and 32s. for October-December or January-March, 1905. Continental consumers would appear to be well supplied for early delivery, and are as a rule only open to purchase for January-June next year. There is little, if any business, doing in South Wales; and consumers only offer very low prices for forward delivery, appearing to be very well supplied for their immediate requirements. Creosote remains in about the same position. There is not much doing, but prices are fairly well maintained, especially in the North, where there is rather more business reported, chiefly for early delivery. As regards London, the difficulty in obtaining casks at a reasonable price prevents a large business being done for export forward. It is reported that business has been done in anthracene all over next year at 2d. per unit for 40-45 per cent., good quality; but as a rule London makers still ask 2½d. Some 90 per cent. benzol has again been sold at 9d. per gallon f.o.b. London, but only small quantities. One maker is reported to have realized 9¼d.; but there are still sellers at under this price. Some 50-90 per cent. has again been sold at 7d. per unit for home consumption; but only very small quantities have been placed at even this low price. There appears to be rather more business doing in solvent naphtha, especially in London. Sales are reported at 8d. and 8½d., according to quality. In the North, there is more inquiry for export; one of the largest makers having made a sale at 7d. per gallon for forward delivery, which is an improvement on prices recently ruling. The demand for crude carbolic acid continues good; but consumers will not pay more than 2s. per gallon for July-October shipment, and it does not seem as if prices would advance much beyond this, at any rate at present. Crystals continue to be offered at very low prices, principally by dealers, who seem anxious to depress prices for forward delivery.

The average values during the week were: Tar, 17s. to 22s. Pitch, London, 31s. 3d. to 31s. 9d.; east coast, 31s.; west coast, 29s. to 30s. Benzol, 90 per cent., 9d.; 50-90 per cent., 7d. Toluol, 6½d. to 6¾d. Crude naphtha, 3d.; solvent naphtha, 7d. to 8½d.; heavy naphtha, 9½d. to 10d. Creosote, London, 1½d.; North, 1⅜d. Heavy oils, 2⅛d. Carbolic acid, 60 per cent., 2s. to 2s. 0½d. Refined naphthalene, £5 to £8; salts, 22s. to 24s. Anthracene, "A" quality, 1¾d. to 1⅞d.; "B" quality, 1d., nominal.

Sulphate of Ammonia.

Markets continue quiet, and although there is really no important change to report, there has been an absence of business during the past week. Beckton still quote £12 2s. 6d. for July-September, and will not accept less at present; while the South Metropolitan Company are asking £12 5s., on their own special terms. Business in Hull has been done at £11 18s. 9d. for early shipment, and £12 1s. 3d. to £12 2s. 6d. for forward. Liverpool is quiet. Prices rule at £11 17s. 6d. to £11 18s. 9d. for prompt; but makers decline at present to offer for forward delivery. At Leith, business is reported at £12, which may be taken as about the value for July shipment; but for August-October, makers are asking considerably higher prices.

COAL TRADE REPORTS.

Lancashire Coal Trade.

Generally the coal trade of Lancashire continues in much the same depressed condition as for some time past. In house-fire coal, there is a very slow sort of business passing through (due mainly to the warmer summer weather of the past week or so), and pits continue to work about three to four days per week. Prices remain unchanged at 13s. to 14s. per ton for best Wigan Arley, 11s. to 12s. for seconds Arley and Pemberton four-feet, and 8s. 6d. to 9s. and 10s. for common house-fire qualities. Steam and forge coals remain unchanged from last week, and average about 9s. 6d. to 9s. 9d. and 10s. for good screened Wigan Arley, and 7s. 9d. and 8s. 3d. to 8s. 6d. and 8s. 9d. for Wigan four-feet. In engine fuel, there is quite as much pressure as last week. This arises through not so much slack being made and the restricted time

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which collieries are working. Prices remain unaltered, and average about 4s. to 4s. 6d. per ton at the pit for common, 5s. to 5s. 6d. for medium slack, and 6s. to 6s. 6d. for best qualities. In coke, there is not much business beyond that reported recently. Shipping remains quiet, with little or nothing doing.

Northern Coal Trade.

There is now an easier tone in some of the branches of the coal trade; but on the whole the production seems to be generally well taken up, and there are some signs that the demand is increasing for at least the best classes of gas coals. Northumbrian best steams are dull at from 10s. to 10s. 3d. per ton f.o.b., second-class steams are quiet at from 8s. 9d. to 9s., and steam smalls are 4s. to 4s. 6d. In the gas coal trade, the fuller demand now may be expected to set in, as the days begin to shorten. The price of Durham gas coals varies from about 7s. 10½d. to 8s. 6d. per ton f.o.b. generally; but one or two collieries which are favourably situated ask a relatively higher price. Gas coke has been rather freely sold forward—one of the large companies on Tyneside having disposed of that part of their make which they export for some months at 13s. per ton f.o.b.

Scotch Coal Trade.

Trade remains as it was. The only change is that there is a strong development of the Baltic trade, which is what is to be expected at this season. Otherwise the demand is very slack. The prices quoted are: Main 7s. to 7s. 3d. per ton f.o.b. Glasgow, ell 7s. 9d. to 9s. 3d., and splint 8s. 3d. to 8s. 6d. The shipments for the week amounted to 268,313 tons—an increase of 23,238 tons upon the previous week, and of 50,866 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,289,635 tons—an increase of 180,494 tons upon the same period of 1903.

International Gas Exhibition, Earl's Court.—We are informed that the following firms have already booked space for the forthcoming Earl's Court Gas Exhibition, several of them having taken a large amount of room, so as to permit of effective displays: Parkinson and Cowan; Anti-Vibration Incandescent Lighting Company; Imperial Stove Company; Graham, Morton, and Co.; S. Clark and Co.; Cannon Iron-Foundries; Moffat's, Limited; Meldrum Bros.; B. Gibbons; Thomas Glover and Co.; Bibbie, Hobson, and Co.; Falk Stadelmann, and Co.; Davis Gas-Stove Company; Alder and Mackay; George Waller and Co.; Chemical Engineering and Wilton's Patent Furnace Company; Meteor Light and Heat Company; James Stott and Co.; United Engineering Company; Automatic Light Controlling Company; Willey and Co.; New Inverted Incandescent Gas-Lamp Company; George Bray and Co.; Temperley Transporter Company; Mobberley and Perry; James Keith and Blackman Company; Planet Foundry Company; and Clark, Harrison, and Co.

Sales of Shares.—Recently Messrs. W. Day and Sons sold by auction £1015 of 5 per cent. capital stock and £227 of 3 per cent. debenture stock in the Maidstone Gas Company. The price realized for the capital stock (paying £7 12s. 6d. per cent.) was £144 per cent.; while the debenture stock sold at the rate of £76 per cent.

New Water-Works for the Bridgwater District.—Since the beginning of August last, work has been going on at Willoughby, a few miles from Bridgwater, in the construction of a reservoir and laying pipes over a distance of 38 miles for the supply of water to a number of parishes under the jurisdiction of the Bridgwater Rural District Council. Bridgwater itself has an excellent supply, and now the district is to have a similar boon. The cost of the undertaking is, roughly speaking, about £25,000. On Monday last week the works were opened by the Chairman of the District Council (Mr. G. E. Lansdowne), who turned on the water to supply the Petherton portion of the district, in which there is a length of some 19½ miles of piping. The ceremony was witnessed by a number of district councillors and others. The party inspected the reservoir, which has a capacity of about 100,000 gallons. Mr. Lansdowne, in performing the opening ceremony, spoke of the keen interest displayed by the District Council in the matter, and their desire to give the inhabitants a pure and reliable supply of water. He paid a tribute to the assistance given to the Council by their Clerk (Mr. T. M. Reed), and also to the work of the Water Committee. The Vice-Chairman (Rev. F. N. Smith) proposed a vote of thanks to Mr. Lansdowne, and it was heartily accorded. The Chairman, in reply, said this was the second occasion he had performed a similar function.

East Surrey Water Company.—At the recent annual general meeting of this Company, the Directors reported a profit of £23,783 for the year ending the 25th of March. Adding the amount brought forward (£1797), there was a total of £25,580. Interim dividends and other charges took £13,949, and £1400 was placed to the credit of the renewal and contingency fund; leaving £10,231 to meet the final dividends. These were recommended to be at the rates of 10, 7, and 5 per cent. (less income-tax); and they amounted to £8430; leaving £1801 to be carried forward. The Directors expressed their regret at losing the services of Sir Frederick Bramwell, rendered during a period of 27 years. The report was adopted, and the dividends recommended were declared. The following resolution was passed: "That this meeting records its deep regret at the death of Sir Frederick Bramwell, Bart., whereby the Company has lost the powerful assistance which it derived for so many years from the deep interest he took in its affairs, and has been deprived of the benefit of his great sagacity, clear insight, and sound judgment. The meeting also desires to express its admiration and esteem for his high character, and is glad to be assured that his connection with the Company afforded him pleasure and satisfaction." At an extraordinary meeting held after the general business had been transacted, the Directors were authorized to raise additional capital by the issue of ordinary £10 shares. A feature of the proceedings was the announcement by the Engineer, Manager, and Secretary (Mr. J. Rathbone Downes) of his impending retirement.

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£7 10s. Net.

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28 inches diameter.

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The Conversion of Coke Dust and Breeze into Large Coke.—In another part of the "JOURNAL" will be found a further communication from Mr. W. R. Herring on this subject. The work from which he makes his extracts, and which he says contains a great deal of useful information to the gas manager, was published in April last, and was reviewed in the "JOURNAL" for May 31. We shall be pleased to obtain copies for readers, at the published price of 5s.

Heywood Corporation Water Supply.—The members of the Heywood Corporation recently visited Nayden and Ashworth Moor to inspect the water-works in course of construction there. They were accompanied by the Engineer (Mr. James Diggle), who furnished a number of interesting particulars in regard to the work. It appears that it will take from two to three years to complete it. When finished, the reservoir will hold about 370 million gallons of water. The original estimate was 350 millions; the added holding capacity being obtained by the removal of a little hill in the centre of the valley. The total expenditure of the Ashworth Moor works up to the 31st of March was £86,137; the capitalized interest amounting to £5495—together, £91,632.

Strange Effects of a Gas Explosion.—Gas explosions have been charged, both rightly and wrongly, with many strange results; but the following perhaps is the most wonderful of all: At the Hants Assizes (reports the "Daily Telegraph") a groom named William Hopper was sentenced to seven years' penal servitude for bigamy. He was married to his wife in 1880, and lived with her on and off till 1899; but for two years during this period he deserted her, and was living with a woman he had bigamously married. In 1900, he similarly married a young woman who was a Sunday school teacher at Brighton. He left her fifteen months after, and was next heard of in 1902 at Kingsclere, where he was once more bigamously married. There were two children by his wife, and one each by the other women. Accused said he was picked out of the *dèbris* after a gas explosion, and, in consequence, lost all memory of his relatives and friends.

The Trouble at West Bromwich Electricity Works.—Last Saturday the Electric Lighting and Power Committee of the West Bromwich Corporation issued a report with reference to the dispute which has arisen between the Chairman (Alderman Pitt) and the employees at the electricity works, mentioned in our "Electric Lighting Memoranda" on the 21st ult. It may be remembered that the men memorialized the Town Clerk on the subject of undue interference by the Chairman. The Committee held two special meetings, at which the memorial, together with other matters pertaining to the department, was considered. The Chairman suggested an arrangement which, in the opinion of the Committee, ought to lead to the more harmonious management of the works in the future. It is to the effect that he will make his visits to the works less frequent, and will require the Electrical Engineer to accompany him around them. The Committee resolved that no increase or decrease of wages, and no appointment or dismissal of men, should take place without being reported to them.

Benoit Gas, Limited, is the title of a Company which has been formed with a capital of £150,000, in £1 shares, to acquire the rights for the United Kingdom granted to L. Benoit de Laitte and L. Rudemann for improvements in the manufacture of machines for producing gas from distilled petroleum; to adopt an agreement with the S.F. Syndicate, Limited, with the concurrence of the Aimé Brilliant; and to carry on the business of manufacturers of, and dealers in, machinery and apparatus for manufacturing, increasing, and improving the illuminating or heating power of gas, spirit, oil, petroleum, and heat-producing agents, &c. There will be no initial public issue.

Reduction in Price at Bristol.—A notice recently issued by the Secretary of the Bristol Gas Company (Mr. John Phillips) furnishes evidence that the Directors are doing their best to popularize the use of gas. It sets forth that the price both within and beyond the borough will be as follows: To consumers of less than 500,000 cubic feet per annum, 2s. 2d. per 1000 feet; to consumers of this quantity per annum (Jan. 1 to Dec. 31) and upwards, if used on the same premises, 1s. 11d. per 1000 feet; for gas used for motive power only, irrespective of quantity, provided certain conditions are complied with, the same price. For the current half year, the reduction to consumers of 500,000 cubic feet and upwards per annum will be made, provided that not less than 250,000 cubic feet of gas are burnt in six months ending Dec. 31 next. From that date the reduced price will be charged, provided 500,000 cubic feet and upwards are consumed between Jan. 1 and Dec. 31. Special rates are being made for prepayment meters.

Trouble with Gas-Irons.—A correspondent of the "Ironmonger" asks for assistance in connection with the above matter. He says: "I have had some trouble with gas smoothing-irons, several of those I have sold having been brought back. All have been accompanied with one complaint—that after using them a little time (say, 20 minutes or so) the flame drops, and ceases to burn with that force and spurt which usually marks the use of these appliances. I have tried the irons myself with a good force of gas from a ½-inch pipe, and find the same results. I wrote to the makers, who asked me to return the burners for examination. They report that all save one were in excellent order—the exception being stopped up; and they add: 'If the gas be kept on at full when the irons are in use, we are certain your customers will highly appreciate them.'" The correspondent asks if other ironmongers have had a similar experience. He says he has no desire to make complaints unnecessarily to makers; but in this instance the trouble has been so general that he hesitates to send out another iron. The Editor appends the following note to the letter: "We have heard of the difficulty before, and, indeed, had an instance in our own house. We formed the opinion that the user of the iron tired after a little time, and then failed to keep the gas-tubing free from kinks and bends. The supply was taken from a cock on a pendant. The arrangement was altered so as to connect to a point in the wall at about table height, and since the change was made we have heard no complaint."

COKE BREEZE

Can be satisfactorily removed by Screens; but by using Little's Conveyors for carrying away the Coke from Retorts, the only Breeze to be handled is that which is inseparable from all systems of carbonizing. This can usually be burned under the Boiler, so very little need be put into the

INCLINED RETORTS.

Breeze is the bugbear of all Gas Engineers, as every cwt. handled is not only a loss in value, but represents wear on the plant.

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SHALLOW INCLINES.

OUR AIM:

NO SUPERFLUOUS BREEZE.
LONG LIFE.
RESULTS BETTER THAN HORIZONTALS.
LOW COST—WITH EFFICIENCY.

NEW CONVEYOR Co., LTD., SMETHWICK.

Mr. Herbert Perkin, of Leeds, has just issued a new catalogue of his cold metal pack saws, which are found to be labour and time savers in the engineering and metal trades.

Mr. W. S. Gilbert, who is well known to many in the gas world, has been appointed London manager, and representative for the South of England, of the Hygienic Gas-Stove Company, Limited.

The Richmond Gas Stove and Meter Company, Limited, have declared, for the half year ending June 30, an interim dividend on the preference shares at the rate of 6 per cent. per annum, and on the ordinary shares at the rate of 10 per cent. per annum.

The Gas Committee of the West Bromwich Corporation have accepted the tender of Messrs. W. C. Holmes and Co., of Huddersfield, for an ammonia and cyanogen extraction machine for the sum of £735, including engine and gearing wheels for driving the machine, and fixed on foundations prepared by the Committee.

The Metropolitan Water Board have awarded Mr. H. E. Haward, the Comptroller of the London County Council, £1000 in appreciation of the services rendered by him during the arbitration proceedings connected with the transfer of the undertakings of the London Water Companies. They have also awarded £150 to Mr. F. W. MacKinney, and £100 to be divided among other officials of the Council who were engaged in the same work.

The Bolsover Gaslight and Coke Company have placed an order with Messrs. Robert Dempster and Sons, Limited, of Elland, for the reconstruction of their plant. The work consists of a new retort-bench, with Waddell's patent regenerators, boiler, and exhauster, tower scrubber, rotary washer, purifiers, steel tank with gasholder, &c. It has to be carried out under the supervision of Mr. E. J. Brockway, of Cleethorpes, the Company's Consulting Engineer.

The Incandescent Heat Company, Limited, has been registered with a capital of £120,000, in £1 shares, to carry on the business of designers, constructors, workers, reorganizers, and improvers of, dealers in, and advisers in respect of furnaces, heating or combustion chambers, tubes, receptacles or surfaces, fuel or boilers, or any apparatus, plant, or arrangements connected with the problems, manner, or means of generating, applying, or using heat or fields of heat, or of obtaining combustion, producers and suppliers of gas, electricity, or other power, tube makers, &c.

It is well known that the consumption of water in New York is enormous, and meters have been advocated as the remedy; but frost is a great difficulty. Service pipes laid 5 feet deep do not always escape. Of meters and metered services, it has been found that 60 per cent. more froze on the south than on the north side of the streets running east and west, but about the same number on each side of the streets running north and south. Of 2904 services that froze—though in about one-half of the cases the meters did not freeze—40 per cent. were on the south side of the streets, 25 per cent. on the north side, 18 per cent. on the east side, and 17 per cent. on the west side.

Colonel W. O. Meade-King, on behalf of the Local Government Board, last Wednesday held an inquiry at Chapel-en-le Frith, into an application of the Rural District Council for sanction to borrow £6750 for the purchase of Dove Holes Water-Works, and £21,244 for the carrying out of a comprehensive water supply scheme for Chapel-en-le-Frith and Chinley, including the purchase for £5200 of the works of the Chapel-en-le-Frith Water Company. The Clerk (Mr. Boycott) said for many years complaints had been made of the insufficiency of the supply of water in the district; and the result of the agitation was the present scheme, which had been prepared by Messrs. Swann and Brady, engineers.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

GAS ENGINEER (Abroad). Office de Publicité, Brussels.
GAS MANAGER. E. J. B., care of Deacon's.
ASSISTANT FOR SOUTH AMERICA. No. 4230.
TRAVELLER. No. 4231.
DRAUGHTSMAN. No. 4228.
DRAUGHTSMEN. S. Cutler and Sons, Millwall.
WORKING FOREMAN (Sulphate of Ammonia Works). No. 4229.
WATER INSPECTOR. Birkenhead Corporation. Applications by July 12.
FITTERS. Grays Gas-Works.
RETORT SETTER. Sandown (I. of W.) Gas-Works.
JUNIORS. S. Cutler and Sons, Millwall.

Situations Wanted.

ACCOUNTANT OR CHIEF CLERK. No. 4220.
AGENCY. No. 4227.
CLERK AND BOOK-KEEPER. Bowd, Tamworth.

Plant, &c., for Sale.

EXHAUSTER AND ENGINE, HYDRAULIC MAINS, &c. Bangor Gas-Works.
GASHOLDER, &c. Stanton Iron Works.
PURIFIER AND TAR-EXTRACTOR. Cannock, Hednesford, &c., Gas Company.
PURIFIERS. Neston Gas-Works.

Plant, &c., Wanted.

PURIFIERS. Stevenston Gas-Works.

Stocks and Shares.

EAST SURREY WATER COMPANY. July 28.
SEVENOAKS WATER COMPANY. July 23.

TENDERS FOR

Coal.

ABERYSTWYTH GAS COMPANY. Tenders by July 20.
ROCHDALE GAS DEPARTMENT. Tenders by July 13.
SHIFNAL GASLIGHT COMPANY. Tenders by July 22.
TEIGNMOUTH GAS DEPARTMENT. Tenders by July 19.
TODMORDEN GAS DEPARTMENT. Tenders by July 15.

Lime.

HEYWOOD GAS DEPARTMENT. Tenders by July 19.

Oxide (New and Spent).

STOCKPORT GAS DEPARTMENT. Tenders by July 20.

Pipes and Fittings.

HEYWOOD GAS DEPARTMENT. Tenders by July 19.

Retort-Bench (Pulling Down and Re-Building)

GLYNCORRWG GAS DEPARTMENT. Tenders by July 25.

Sulphuric Acid.

HEYWOOD GAS DEPARTMENT. Tenders by July 19.

Tar and Ammoniacal Liquor.

ABERYSTWYTH GAS COMPANY. Tenders by July 11.
HEYWOOD GAS DEPARTMENT. Tenders by July 19.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
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J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
Telegrams:—
"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

DUTCH OXIDE OF IRON.

THE First Dutch Bog Ore Co., Ltd., (Eerste Hollandsche Yzererts Maaty), ROTTERDAM.
General Manager (for England and Wales)—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.
London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

SULPHURIC ACID.

SPECIALLY prepared for the Manufacture of SULPHATE OF AMMONIA.
SPENCER, CHAPMAN, AND MESSEL, LIMITED, 96, Mark Lane, LONDON, E.C. Works: SILVERTOWN.
Telegrams: "HYDROCHLORIC, LONDON."
Telephone: 341 AVENUE.

OXIDE OF IRON.
(NATURAL.)

BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.
BALE'S FIRE CEMENT, PAINT, AND GAS COAL,
5, CROOKED LANE, LONDON, E.C.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PATENTS AND TRADE MARKS
PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.

H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

THE KEITH LIGHT.

OVER 1600 INSTALLATIONS IN DAILY USE.

SEE illustrated advertisement in next week's issue.

JAMES KEITH AND BLACKMAN, CO., LTD., 27, Farringdon Avenue, LONDON, E.C.

TO GAS AND WATER OFFICIALS.

MELROSE CYCLES and Slot Copper COLLECTORS. Latest Design and lowest Prices. For Cash or gradual payments. Catalogue free.

MELROSE CYCLE COMPANY, COVENTRY.

COAL GAS TAR wanted.

ROBINSON BROTHERS, LIMITED. Works: WEST BROMWICH, KNOTTINGLEY, and SPONDON.

"NUGEPE" CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.

For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.

For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."

Largest Practice and most Up-to-Date Works in Britain.

JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

COAL GAS TAR wanted.

BEST PRICES GIVEN.

SHARPNESS CHEMICAL COMPANY, LIMITED, Sharpness Docks, GLOS.

AMMONIACAL Liquor wanted by JOHN RILEY & SONS, Hapton, near ACCRINGTON.

ADVERTISER wishes for an Agency in London and District for General Gas Plant. A good Connection.

Address No. 4227, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a Young Man (aged 24, married), a situation as Clerk and Book-Keeper. Several years' Experience of Gas-Works Accounts, especially Gas-Rental. Good References from past and present employers.

Address S. BOWD, Gas-Works, TAMWORTH.

APPOINTMENT Wanted as Account- ANT or CHIEF CLERK in a Gas or Gas and Water office. Over Twelve Years' Experience. First-class Testimonials.

Address No. 4220, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RETORT-SETTER wanted for Two or Three Weeks for Renewals.

Apply, to the MANAGER, Gas-Works, Sandown, ISLE OF WIGHT.

WANTED, Two good Fitters for Indoor Slot Fitting. Must be used to Iron and Compo. Good Character indispensable.

Apply to the MANAGER, Thos. E. Shadbolt, Gas-Works, GRAYS.

WANTED, a Working Foreman to take charge of a small Sulphate of Ammonia Works. Wages £2 10s.

Address No. 4229, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Gas Engineer to under- take the Management of an Important Gas Company abroad (beyond the Sea).

Apply, by letter, to A.S., No. 50, care of OFFICE DE PUBLICITE, rue de la Madeleine, BRUSSELS, BELGIUM.

WANTED, at once, a good Draughts- man, for a few Months. One used to Gasholders and Ironwork construction generally. Salary £2 10s. per week.

Apply, by letter, to No. 4228, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Manager wanted for a Large Works in the Midlands. Preference given to one with experience in the Birmingham District.

Apply, stating Age, Qualifications, and Salary required, to E. J. B., care of Deacon's Advertising Offices, LEADENHALL STREET, E.C.

TRAVELLERS now calling upon Gas Companies and the Trade wanted immediately, to push a special Article in high demand.

Apply, stating Terms wanted, district covered, and the Goods represented at present, to No. 4231, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ROBERT DEMPSTER & SONS, Ltd., Contractors for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, ROSE MOUNT IRON-WORKS, ELLAND.

DRAUGHTSMEN required imme- diately. Permanency if satisfactory. Also vacancies for JUNIORS.

Apply, by letter, stating Age, previous Experience, and Salary expected, to S. CUTLER AND SONS, Gas Engineering Works, Millwall, LONDON.

WANTED, for a South American Gas- Works, an ASSISTANT who has Practical Experience in Gas Manufacture, &c., and understands Office Work. Three Years' Engagement. Passage out and Home free. Commencing salary £250 per annum, with Residence free.

Applications, stating Age, whether Married, Qualifications, and previous Experience, and enclosing *copies* only of recent Testimonials, to No. 4230, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

COUNTY BOROUGH OF BIRKENHEAD.

TO REGISTERED PLUMBERS.

THE Gas and Water Committee of the Birkenhead Corporation require the services of a Plumber to act as CHIEF WATER INSPECTOR.

Applicants must be registered plumbers (by examination); they must also be accustomed to the working of the Deacon Waste-Water Meter System, and be accustomed to the Control of Men.

The commencing wage will be 35s. per week, with uniform.

Applications, in candidates' own handwriting, together with *copies* of three recent Testimonials, to be sent to the Water Engineer, 52, Balls Road, Birkenhead, not later than Tuesday, the 12th of July, 1904, and endorsed "Chief Water Inspector."

Corporation Water-Works,
Engineer's Office, 52, Balls Road,
Birkenhead, July 1, 1904.

TAR Contracts Wanted on the Sliding- Scale or at Fixed Prices.

Managers and Secretaries desirous of selling to best advantage, please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

WANTED, a set of Four Purifiers, 10 feet square.

Apply GAS-WORKS, STEVENSTON.

FOR SALE—Two 6 feet by 6 feet Puri- FIERS, by Dempster, with two Four-Way Valves. Replaced by larger

Apply to A. E. ASHLEY, Manager, Gas-Works, NESTON.

FOR SALE—A Gasholder, 37 feet dia- meter by 18 feet deep. Capacity 20,000 cubic feet. Also Five IRON COLUMNS, with Chains, Weights, and Stone Curb.

Apply to the STANTON IRON-WORKS COMPANY, LTD., Teversal, MANSFIELD.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.

J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

GASHOLDER, 40 ft. diameter by 14 ft. deep, in wrought Tank, with six Columns, trellis Girders, and Suspension Gear. In splendid condition. Nearly new.

New GASHOLDER, 40 ft. diameter by 12 ft. deep, with Steel Standards; also new STEEL TANK to contain same.

Write J. WRIGHT, 181, Queen Victoria Street, LONDON, E.C.

GASHOLDERS AND TANKS FOR SALE.

TWO splendid Double-Lift Gasholders, in Cast-Iron Tanks—40,000 and 60,000 cubic feet Capacity respectively, WILL BE SOLD at a sacrifice to immediate purchasers to save carriage. Now being Dismantled, and could be erected for use for the coming Winter if sold at once.

Full Particulars and Photographs on application to FIRTH BLAKELEY AND CO., Gas Engineers, Thornhill, YORKS.

CANNOCK, HEDNESFORD, AND DISTRICT GAS COMPANY, LIMITED.

OFFERS invited for One C. & W. Walker's PURIFYING-MACHINE, with TAR EXTRACTOR, 10-inch Valves and Connections Complete, to pass 200,000 cubic feet of Gas per Twenty-Four hours. The above Machine may be seen working, and is being replaced by a larger one.

By order of the Directors.
T. A. NICHOLLS,
Secretary.

Gas-Works, Cannock.

GAS PLANT FOR SALE.

THE Corporation of Bangor, North Wales, have the following PLANT for Sale:—

One 10,000 feet per hour EXHAUSTER, with STEAM-ENGINE on one Bed-Plate.

Two lengths of HYDRAULIC MAIN, with 7-inch Valves, 5-inch H Pipes, and 6-inch to 5-inch Ascension Pipes.

The Engine may be seen in use.

Further Particulars may be had on application to the undersigned.

JOHN SMITH,
Manager.

June 10, 1904.

ABERYSTWYTH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Aberystwyth Gas Company invite TENDERS for the supply of 4000 Tons or more of GAS COAL, Screened, Unscreened, and Nuts, to be delivered at a Aberystwyth Station, during the period of Twelve Months, commencing Sept. 1, 1904, and ending Aug. 31, 1905.

Tenders to be delivered on or before the 20th of July inst.

R. J. JONES,
Secretary.

Gas Offices: Aberystwyth,
July 1, 1904.

TENDERS FOR SURPLUS TAR.

THE Directors of the Aberystwyth Gas Company are prepared to receive TENDERS for the surplus TAR produced at the Works for the period of Twelve Months from July, 1904, to July, 1905.

Tenders to be received on or before the 11th of July inst.

R. J. JONES,
Secretary.

Gas Offices: Aberystwyth,
July 1, 1904.

GLYNCORRWG URBAN DISTRICT COUNCIL.

TENDERS are invited by the above Council for taking down Ironwork, pulling out old Setting of Three, and Supplying a Bed of Five, together with all the necessary Materials that may be required.

Further Particulars, if necessary, may be obtained of Mr. W. P. Jones, Council Offices, Cymmer, Port Talbot.

Sealed Tenders, endorsed "Tenders for Setting," to be in our hands on or before July 25, 1904.

The Council do not bind themselves to accept the lowest or any Tender.

MESSRS. CUTHBERTSON AND POWELL,
Clerks.

58, Water Street, Neath.

TEIGNMOUTH URBAN DISTRICT COUNCIL.

THE Gas Committee of the above Council invite TENDERS for the supply of 2600 Tons of best Durham, or other good GAS COAL, screened or unscreened. Same to be supplied to the requirements of the Council, between the 31st day of July, 1904, and the 30th day of June, 1905.

The Coal must be Fresh Wrought and free from all Impurities.

No special Tender Form will be issued.

Tenders must be accompanied by a full Description and practical Working Analysis of the Coals quoted, and may be f.o.b., c.i.f., Teignmouth Harbour, or f.o.r., Teignmouth Railway Station.

Sealed Tenders, endorsed "Gas Coals," to be sent to the undersigned not later than Tuesday, the 19th day of July, 1904.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
J. ALEX. GRAY,
Gas Manager.

BOROUGH OF TODMORDEN.

(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS f the supply of 12,000 Tons of Screened or Unscreene GAS COAL and 2000 Tons of CANNEL, to be delivere over the ensuing Twelve Months, in such Quantitie and at such times as may be required by the Ga Engineer.

Further Particulars and Forms of Tender may be obtained on application to the undersigned.

Sealed and endorsed Tenders to be delivered at the Town Clerk's Office, Town Hall, Todmorden, addressed to the Chairman of the Gas Committee, on or before July 15, 1904.

The Committee do not bind themselves to accept the lowest or any Tender.

By order,
H. HAWKINS,
Engineer.

Gas-Works, Todmorden,
July 1, 1904.

SHIFNAL GASLIGHT AND COKE COMPANY.

TENDERS FOR GAS COAL.

THE Managing Partners of the above Company are prepared to receive TENDERS for the supply of 1000 Tons, or less, of a good quality of GAS COAL or large NUTS, including carriage to G.W.R. Station, Shifnal, Salop, for a period of Twelve Months from, or about, the end of August next.

Tenders to be accompanied by practical working Analysis.

The Coal and Nuts to be free from Sulphur, Bats, Refuse, or Dirt, and to be weighed upon the Company's Machine.

The supply to be in such quantities weekly as may be ordered by the Clerks to the Company.

Payments will be made from time to time so long as the Contractor shall duly fulfil his contract.

The Managing Partners do not pledge themselves to accept the lowest or any Tender.

Sealed Tenders, endorsed "Tender for Gas Coal," must be delivered at our Offices, Victoria Road, Shifnal, Salop, not later than Friday, the 22nd day of July inst.

By order,
FARMER AND FARMER,
Joint Clerks to the said Company.

July 1, 1904.

BOROUGH OF ROCHDALE.

TO COALOWNERS AND OTHERS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of screened GAS COAL or NUTS, for a period of Twelve Months from the 1st of August, 1904; the quantity required being about 55,000 Tons.

Forms of Tender may be obtained on application to Mr. T. Banbury Hall, the Manager at the Gas-Works, Dane Street.

Tenders, endorsed "Coal," must be sent in to me not later than noon on Wednesday, July 13, 1904.

By order,
JAMES LEACH,
Town Clerk.

Town Hall, Rochdale,
July 1, 1904.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of LIME, TUBES and FITTINGS, and SULPHURIC ACID; and also for the purchase of surplus TAR.

Specification and Form of Tender may be obtained from Mr. W. Whatmough, the Gas Manager.

Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the Trade Conditions which attach to the various kinds of work for which the Tender is sent in.

Sealed and endorsed Tenders to be sent to me not later than Tuesday, July 19, 1904.

By order,
GEO. G. BOUCHIER,
Town Clerk.

Municipal Buildings,
Heywood, June 14, 1904.

COUNTY BOROUGH OF STOCKPORT.

(GAS AND ELECTRICITY DEPARTMENT.)

OXIDE OF IRON.

THE Gas and Electricity Committee are prepared to receive TENDERS for about 500 Tons of OXIDE OF IRON; moisture not to exceed 40 per cent.

Firms tendering must specifically state the district from where the Oxide is obtained, and the Price delivered on Rails at Stockport Station.

The Committee are also prepared to receive Tenders for about 300 Tons of SPENT OXIDE.

Particulars and Forms of Tender can be obtained from the Engineer, Mr. S. Meunier.

Separate Tenders, endorsed "Oxide of Iron" or "Spent Oxide," as the case may be, to be addressed to the Chairman of the Gas Committee, and delivered on or before July 20 next ensuing.

By order,
ROBERT HYDE,
Town Clerk.

Stockport, July 1, 1904.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

EAST SURREY WATER COMPANY.

SALE OF ORDINARY SHARES BY TENDER.

NOTICE is hereby Given, that it is the intention of the said Company to SELL BY TENDER EIGHT HUNDRED ORDINARY SHARES of £10 each of and in the East Surrey Water Company.

The last day for the reception of Tenders will be Thursday, the 28th day of July next, at Twelve o'clock at noon.

Forms of Tender, with Particulars of Sale and Conditions of Tender attached, can be had upon application at the Company's Office, Redhill, Surrey.

By order,
J. R. DOWNES,
Secretary.

Redhill, Surrey, June 23, 1904.

SEVENOAKS WATER-WORKS COMPANY.

NOTICE is Hereby Given, that the Sevenoaks Water-Works Company, in pursuance of their Provisional Order of 1900, as confirmed by Act of Parliament, being desirous of increasing their Capital, have resolved to issue

THREE HUNDRED AND FIFTY 4 PER CENT. PREFERENCE SHARES OF £10 EACH.

Tenders are Hereby Invited from the Public for the same, at not less than par value.

The present issue of capital is made to provide for an additional Pumping Plant, new Reservoirs, and new Mains at Seal Chart, Stone Street, and Bitchet.

The Company are now paying the maximum dividend on their Stock and Share Capital.

The Shares are payable as under—viz.:
£2 on Application,
£3 on Allotment,
and the Balance within Three Months of Allotment.

Tenders are to be addressed to the Company, at their Offices, Oak Lane, Sevenoaks, on or before the 23rd day of July, 1904, and endorsed "Tender for Shares."

Where no allotment is made, the deposit will be returned in full.

Forms of Tender on application at the Company's Offices.

By order of the Board,
ALFRED GRAINGER,
Secretary

Water-Works Offices, Oak Lane,
Sevenoaks, June 13, 1904.

STEAM, OIL, and WATER.

Any Range of Pressure.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS.

No. 1. No. 2. No. 3.

43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

RAILS.

New and Second-Hand with all Accessories; also Tip Waggons and Turntables.

B. M. RENTON,
MIDLAND WORKS,
SHEFFIELD.

THE
"ROTARY"
STATION METER.

Efficiency Demonstrated.

APPLY—

T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE, MANCHESTER.

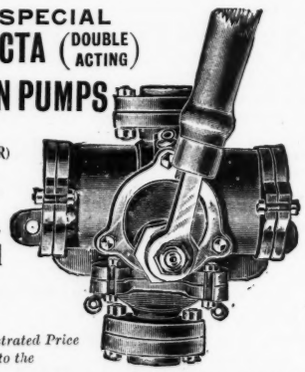
JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

SPECIAL
PERFECTA (DOUBLE ACTING) PISTON PUMPS
HAND OR POWER)
FOR
Tar and Ammoniacal Liquor, &c.



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GEORGE FISCHER STEEL & IRON WORKS
20, HIGH HOLBORN, LONDON. LTD.,

THE PATENT
"BEACON" GLOBE LAMP.

Largely adopted by many Local Authorities for Public Lighting, being absolutely Shadowless and Wind-proof.

H. GREENE & SONS, Limited,
Surrey Engineering Works,
Blackfriars Road, LONDON.
Telephone 1693 HOP.
Telegrams: "LUMINOSITY LONDON."

TROTTER, HAINES, & CORBETT, LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

"Invaluable to those engaged in lighting works."—ENGINEERING.

Now Ready. Twenty-Seventh Year of Issue. Revised to June, 1904.

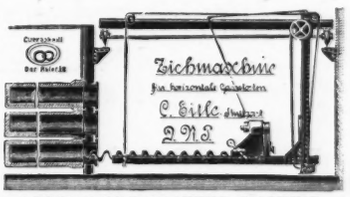
GAS-WORKS DIRECTORY & STATISTICS,
FOR 1904.

With List of Associations and Alphabetical List of Chairmen, Engineers, Managers, and Secretaries.
Price, Cloth, 10s. 6d. Net.

SEND FOR PROSPECTUS AND SPECIMEN PAGE.
LONDON: HAZELL, WATSON, & VINEY, LD., 52, LONG ACRE, W.C.

C. EITLE, ENGINEERING WORKS, STUTTGART.
Telegraphic Address: "EITLE, STUTTGART." Telephone: No. 635.

"KOBOLD" CHARGING APPARATUS.



"SCHLANGE" DRAWING MACHINE.

ADVANTAGES OF THE "KOBOLD" CHARGING APPARATUS.

1.—The simplest of all existing Charging Machines, as in charging there is only ONE shaft working.
2.—Almost indestructible in construction, as there are no combustible parts exposed to the heat of the Retorts.
3.—Uniform bed of coal of any desired height in the retort, and consequently any desired weight of charge may be inserted.
4.—Greater yield of gas in comparison with all other types, owing to the coal being deposited in the retort most advantageously.
5.—Least inrush of cold air owing to the close fit of the charging mouthpiece with the retort mouthpiece, with consequently practically no cooling of the retort, the least outrush of flame and smoke, and therefore smallest loss of gas.
6.—Smallest consumption of power.
7.—Most rapid working, as the complete charging of a retort requires only two pulls of a lever.
8.—May be set at any position in regard to height by either manual or motor power.
9.—Lowest cost to purchase; paying interest and redemption in about three years.

ADVANTAGES OF THE "SCHLANGE" DRAWING MACHINE.

1.—The simplest and best drawing machine in the world for horizontal retorts.
2.—Least time required to draw a retort (10-15 seconds).
3.—Most careful treatment of the lumps of coke, as well as the retort.
4.—Smallest consumption of power.
5.—Lowest cost to purchase.
6.—Most substantial construction, and consequently very low maintenance charges.
7.—Rapid and cheap working, consequently pays interest and redemption in a few years.

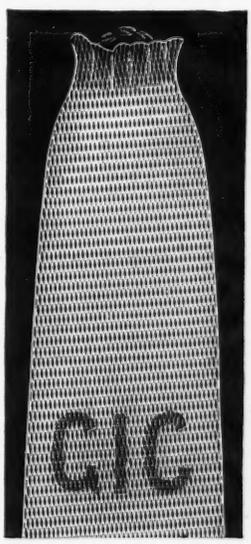
G.I.C.
RAMIE

G.I.C. Pure Ramie Mantles are rapidly becoming the recognized Maintenance Mantles with most Gas Companies and Lighting Authorities.

No better Mantle can be produced; therefore **why pay more?**

Made in 6 different sizes, from the Gem to the Lucas.

The difficult problem of Profitable Maintenance may be at once effectually solved by using this Mantle.



G.I.C.
RAMIE

PRICES. BURNERS.	Per Gross Subject.
G.I.C. Pure Ramie Mantle for "C." .	27s.
G.I.C. „ „ „ No. "2" Kern	27s.
G.I.C. „ „ „ No. "3" „	27s.
G.I.C. „ „ „ No. "4" „	30s.
G.I.C. „ „ Long „ High Pressure	45s.
G.I.C. „ „ „ Lucas Lamp	7s. per doz.

A trial gross for testing will be sent at these Prices on receipt of order, carriage paid.

SOLE MANUFACTURERS:
The GENERAL INCANDESCENT COMPANY, Ltd.,
Telegrams: "ASABLAZO, LONDON." **56, CITY ROAD, LONDON, E.C.** Telephone No. 9536 London Wall.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for
METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
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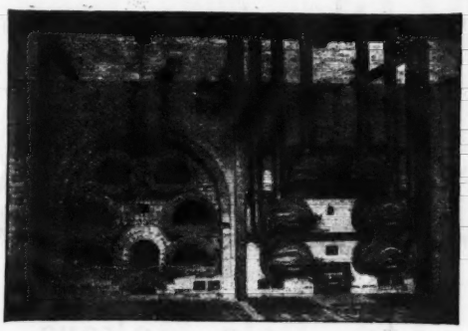

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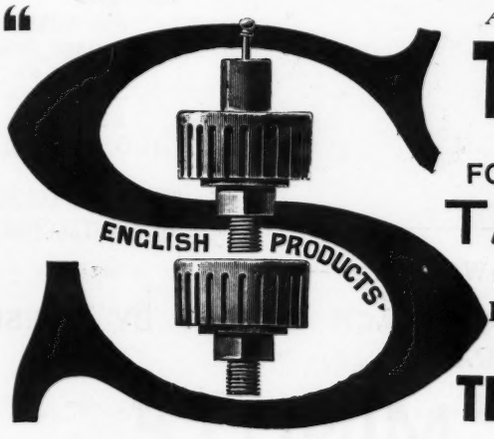

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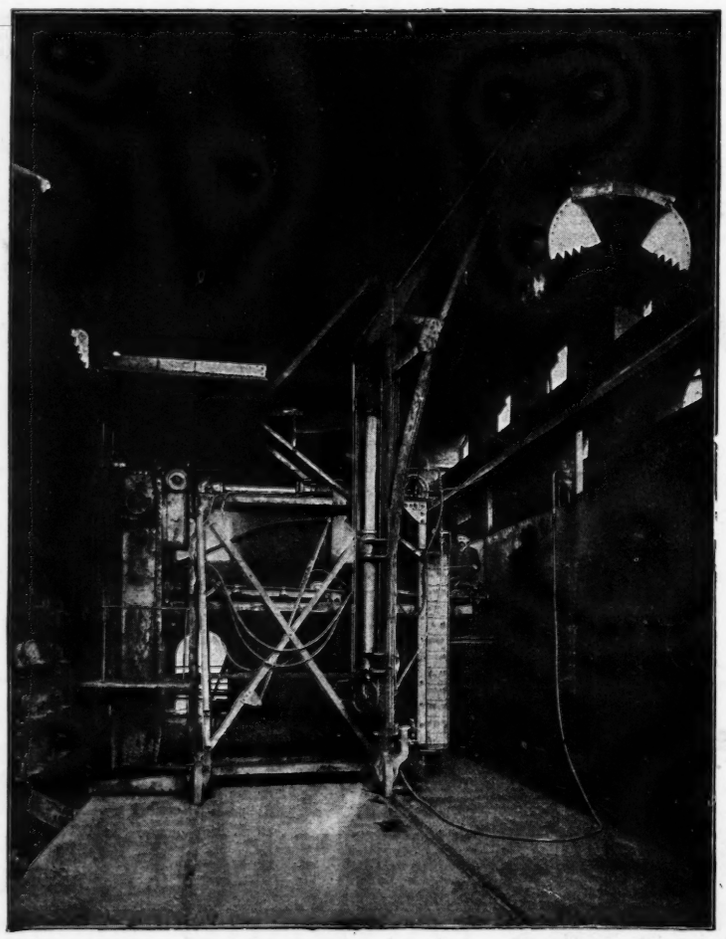

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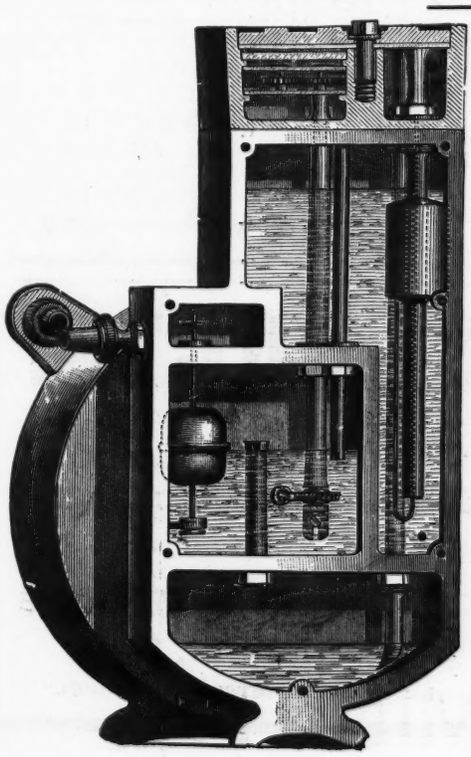

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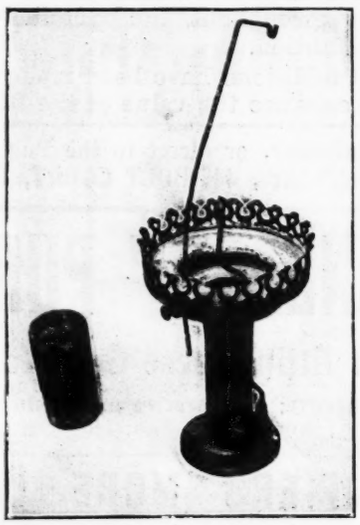
Chap. V. **The Humors of Gas-Fitting** July 5, '04.

In the accompanying illustration it is desired to convey some impression of how a Lucas Light burner *may* look on being returned to Messrs. MOFFAT'S, LTD., 155, Farringdon Road, E.C. I am sadly aware that the shock administered to my readers' feelings by an inspection of this picture, cannot be anything but a mere reflection of the revulsion experienced when confronted with the original of it. As it is, however, the intelligent reader cannot fail to observe how remote is the resemblance of this to a burner of shining brass—which it *was* at an earlier stage of its uneventful career. The asbestos-washer is an indescribable mass of grey and black; the mantle-rod is in a unnaturally obsequious attitude; the bye-pass nipple is beyond recognition; the gauze has been improved by knocking the centre out of it, but—what my readers cannot see—in order to counteract any liability to pass improperly mixed air and gas, a second gauze has been forced into the gauze-ring, where it may still be seen grinning at one with its one and only eye, all the meshes being duly clogged up as becomes a respectable, mature gauze.



It should be explained that, though the lamp from which this was taken is a couple of years old, the outside portions of it were good-looking and excellently kept. But the user had evidently considered it of no earthly consequence whether he touched the burner parts or not. This is a dangerous lack of imagination, or an extraordinary inability to follow a ew simple instructions. And it is quite conceivable that the man thought the lamp a very unreasonable device, when it refused to work in spite of such flagrant neglect, in spite of the undisturbed accumulations of months. But it really would be within its right if it struck work under such conditions. I hope my readers will not forget to impress upon their clients that mechanical appliances are in some measure like human beings—they require up-keep and cleanliness to keep "fit."

(For Chapter VI., See the "*Gas World*," July 9.)

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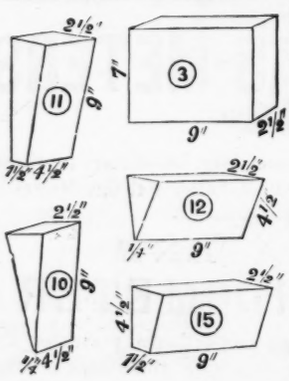

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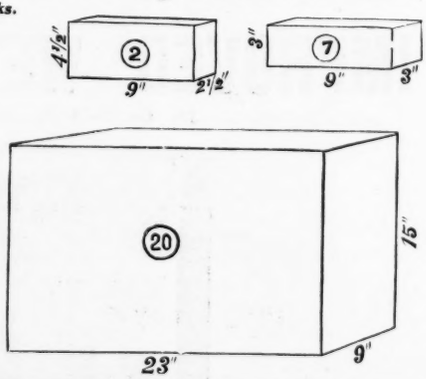

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See **Prof. VIVIAN B. LEWES'S** Lecture before Society of Arts, reported in the "JOURNAL OF GAS LIGHTING," Dec. 9, 1902.

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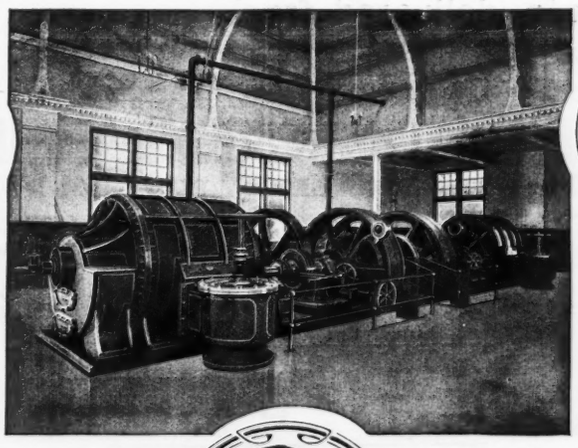

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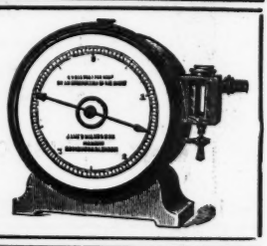

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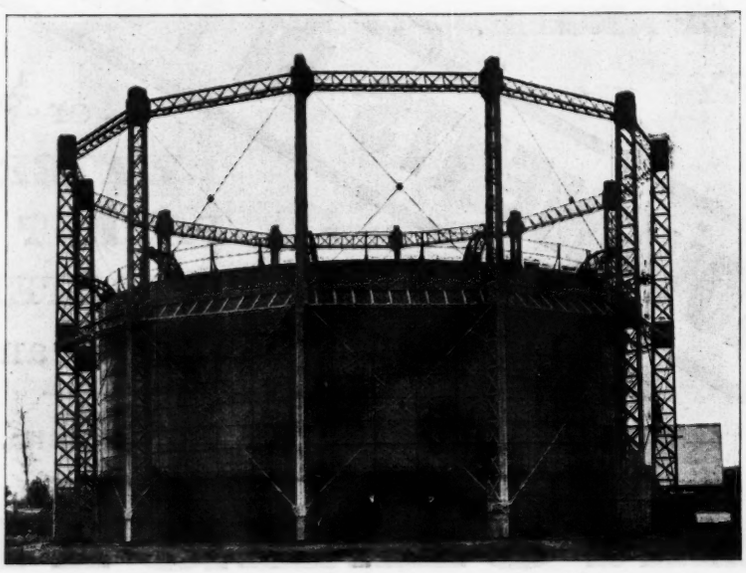

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